

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Department
of Agriculture

Forest Service

Intermountain
Research Station

Research Paper
INT-RP-496

October 1997



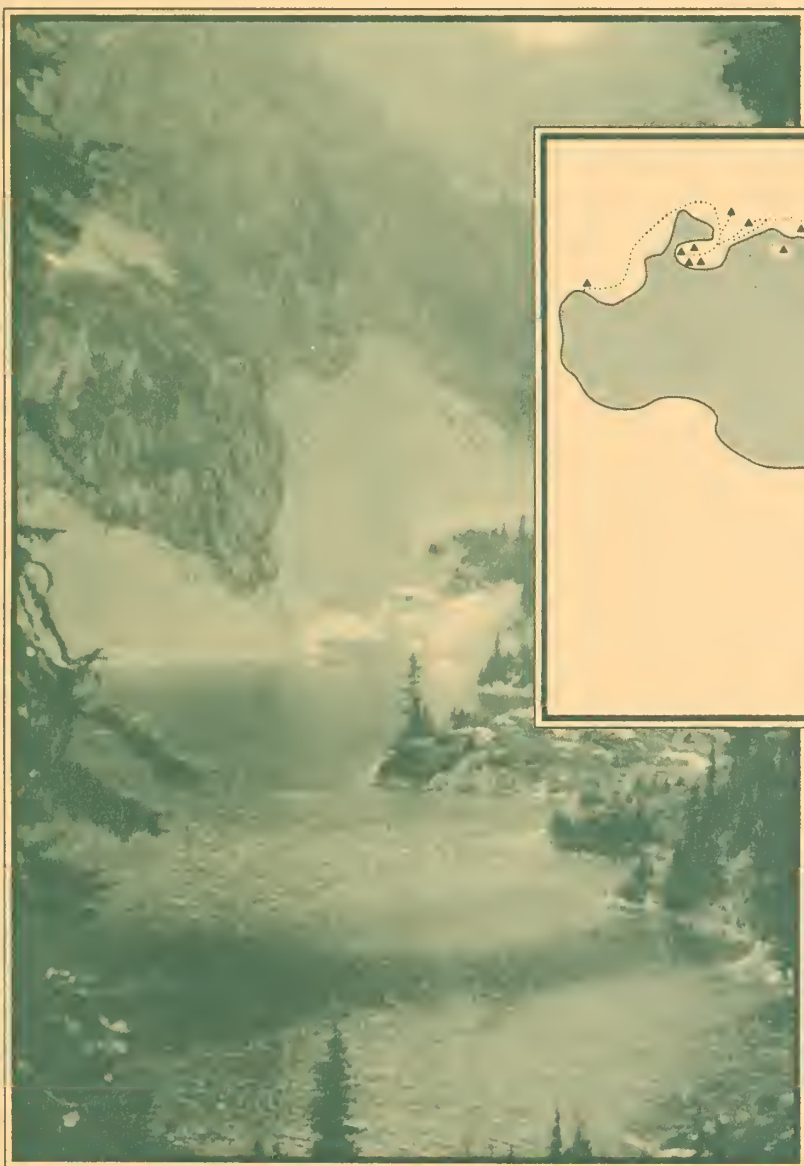
High-Use Destinations in Wilderness: Social and Biophysical Impacts, Visitor Responses, and Management Options

David N. Cole
Alan E. Watson
Troy E. Hall
David R. Spildie

PACIFIC SOUTHWEST
RESEARCH STATION

NOV 04 1997

LIBRARY AND INFORMATION
CENTER COPY



The Authors

David N. Cole is a Research Biologist for the Aldo Leopold Wilderness Research Institute, Missoula, MT. He received his B.A. degree in geography from the University of California, Berkeley, in 1972, and his Ph.D. degree, also in geography, from the University of Oregon in 1977. He has written many papers on wilderness management, particularly the ecological effects of recreation use.

Alan E. Watson is a Research Social Scientist for the Aldo Leopold Wilderness Research Institute, Missoula, MT. He attended the School of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University, Blacksburg, receiving a B.S. and M.S., and in 1983, a Ph.D. degree. His research interests are primarily in wilderness experience quality, including the influences of conflict, solitude, and visitor impacts.

Troy E. Hall is an Assistant Professor, Department of Forestry, Virginia Polytechnic Institute and State University, Blacksburg. She received a B.A. degree in anthropology from Pomona College, CA, in 1985, an M.A. degree in anthropology from Duke University, NC, in 1990, and a Ph.D. degree in forest recreation from Oregon State University in 1996. She has conducted research on both wilderness visitors and the ecological impacts they cause.

David R. Spildie is a Biologist for the Aldo Leopold Wilderness Research Institute, Missoula, MT. He received a B.S. degree in zoology from the University of Wisconsin in 1975 and an M.S. degree, also in zoology, from the University of Wyoming in 1994. His interests include human impact on wilderness ecosystems, ecological relationships of fire, small mammals and vegetation, and the use of the Geographic Information System in wilderness management.

You may order additional copies of this publication by sending your mailing information in label form through one of the following media. Please specify the publication title and Research Paper number.

Telephone	(801) 625-5437
DG message	Pubs:S22A
FAX	(801) 625-5129, Attn: Publications
E-mail	/s=pubs/ou1=s22a@mhs-fswa.attmail.com
Mailing Address	Publications Distribution Rocky Mountain Research Station—Ogden (formerly) Intermountain Research Station 324 25th Street Ogden, UT 84401

Rocky Mountain Research Station—Ogden
(formerly) Intermountain Research Station
324 25th Street
Ogden, UT 84401

Research Summary

To better understand how high-use destination areas a short distance from trailheads and close to urban areas might best be managed, we studied six such areas in the Alpine Lakes, Mount Jefferson, and Three Sisters Wildernesses in Washington and Oregon. We quantified recreation impacts on system trails, social trails, campsites, and lakeshores. We also quantified visitor encounter rates between groups, during the day and in the evening, on the trail, and at the destination. We conducted exit interviews with visitors to explore who they were, what they encountered, their responses to what they encountered, and their management preferences.

Encounter rates in these destination areas were extremely high, clearly exceeding those preferred by most visitors. Most visitors expected to have numerous encounters, and most were not bothered by the high encounter levels they experienced. Only 10 to 23 percent supported reducing use levels.

Recreation use has caused substantial impact in these destination areas, although generally not more than has been reported in many other wildernesses. Most visitors noticed these impacts and reported that impacts detracted from their experience. Visitors were highly supportive of site management approaches such as trail or site closure programs and revegetation programs.

Potential management approaches for dealing with problems in these areas are: (1) increasing visitor education, (2) reducing amount of use (by day users, overnight users, or both), and (3) increasing site management. Intensifying site management programs would have the highest ratio of benefits to costs.

Contents

	Page
Introduction	1
Study Sites and Methods	2
Recreation Impacts	2
Social Impacts	3
Visitor Survey	4
Descriptions of Destination Areas	4
Snow Lake	4
Rachel Lake	5
Rampart Lakes	5
Marion Lake	7
Sunshine-Obsidian Falls Area	7
Green Lakes	7
Visitor Encounter Levels	9
Recreation Impacts	11
Visitors to Destination Areas	15
Visitor Characteristics	15
Visitor Expectations and Responses to Conditions	17
Preferences for Management	20
Summary	21
Discussion and Management Implications	22
Encounters, Visitor Evaluations, and Management Preferences	22
Physical Impacts, Visitor Evaluations, and Management Preferences	23
Likely Effects of Alternative Management Approaches	24
Visitor Education Programs	24
Reductions in Amount of Use	25
Intensive Site Management	27
Combinations of Management Approaches	28
Methodological Suggestions	28
Conclusions	28
References	29

High-Use Destinations in Wilderness: Social and Biophysical Impacts, Visitor Responses, and Management Options

David N. Cole
Alan E. Watson
Troy E. Hall
David R. Spildie

Introduction

The primary objectives of wilderness recreation management are to protect natural conditions and to provide opportunities for solitude or primitive and unconfined recreational experiences. In wilderness, management presence and human impacts on natural ecosystems will, ideally, be negligible, and encounters between different groups of people will be infrequent (Hendee and others 1990). This ideal is difficult to achieve anywhere, but particularly at popular destination areas within wilderness. Attractive destinations short distances from trailheads, tend to be heavily used by recreationists, particularly if the trailheads are close to large metropolitan areas. Recreation impacts are often severe and widespread, encounters with other groups occur frequently, and the evidence of management is readily apparent.

Managers of high-use destination areas have struggled for years over how best to manage these areas (Hendee and others 1990; Snyder 1966), and in many places, they have done little to deal with problems. Many are reluctant to regulate use; they feel they cannot afford to administer and enforce regulations. As a result, such areas continue to provide recreational opportunities for large numbers of people, but they may not meet visitor's definitions of high-quality wilderness.

In other places, managers have decided that conditions are unacceptable and have directly attacked one cause of the problem—too many people—by reducing or limiting amount of use (Hendee and others 1990; Stankey 1979). Many of the destinations where this action has been taken have benefited; for example, impacts have been limited, as have encounters between groups of visitors. This approach, however, has several costs. First, access is denied to many people who want to visit the area. Second, many of the people who are denied access go elsewhere and contribute to problems in other wildernesses or on nonwilderness lands.

Management responses to problems at high-use destinations are determined to a great extent by agency policy and tradition (Fish and Bury 1981). National Park Service wilderness managers are much more likely to adopt a regulatory management program than managers of other agencies. Considerable variation in response appears to result from personal opinion and, in almost all cases, actions are taken without much pre-existing data on the nature and extent of the problems being attacked.

Decisions about management of high-use destinations should be based on a thorough understanding of levels of human impact in the area and the effects on visitors of conditions and of management responses to those conditions. Various management options should be considered regarding the improvements they might bring about and the costs of those actions—denied access, displacement of use and impact, and management obtrusiveness. Managers need to answer such questions as:

1. How crowded are these places?
2. How do visitors feel about current visitor encounter levels or about management attempts to reduce them?
3. How severe are recreation impacts?
4. How do visitors feel about current impact levels or about management attempts to reduce impacts?
5. How is the severity of problems changing over time?
6. Which management approaches are visitors most likely to support?
7. Which management approaches are most likely to benefit visitors and resources of these destination areas and surrounding wilderness lands?

To develop further insight into these questions, we studied six high-use destination areas in three wildernesses on National Forests in Oregon and Washington. Our objectives were to use a case study approach to:

1. Describe the current resource and social conditions of high-use destinations.

2. Better understand the visitors to high-use destinations—who they are, their response to what they encounter, and their management preferences.

3. On the basis of this information, explore the pros and cons of some of the divergent management approaches that might be taken.

Study Sites and Methods

During 1991 and 1992, we studied six high-use destinations within wildernesses located in the Cascade Mountains of western Oregon and Washington: the Snow Lake, Rachel Lake, and Rampart Lakes areas in the Alpine Lakes Wilderness; Marion Lake in the Mount Jefferson Wilderness; and Green Lakes and the Sunshine-Obsidian Falls area in the Three Sisters Wilderness (fig. 1 and 2). All three of these wildernesses are relatively large; Mount Jefferson is about 43,000 ha, Three Sisters is 115,000 ha, and Alpine Lakes is 159,000 ha. The Alpine Lakes is the most heavily used wilderness in Washington; Mount Jefferson and Three Sisters are among the most heavily used wildernesses in Oregon.

In each area, we conducted three related studies. First, we quantified physical recreation impacts in the area. Second, we quantified encounter rates as an

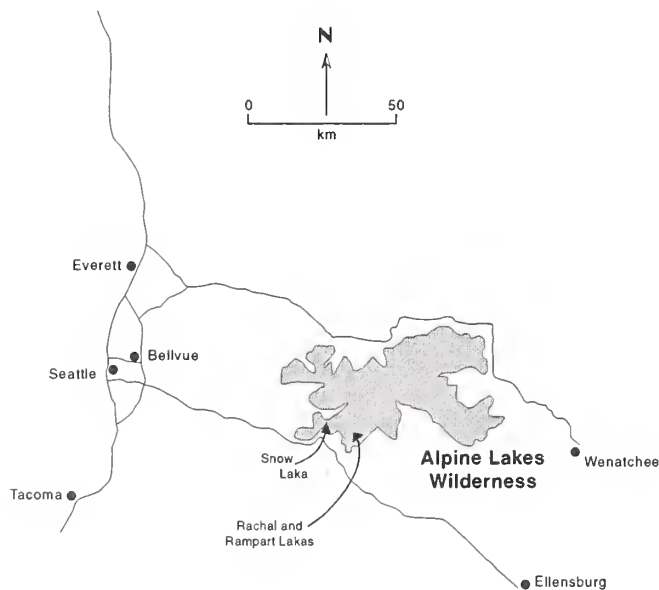


Figure 1—Location of the Snow Lake and Rachel-Rampart Lakes destination areas within the Alpine Lakes Wilderness, WA.

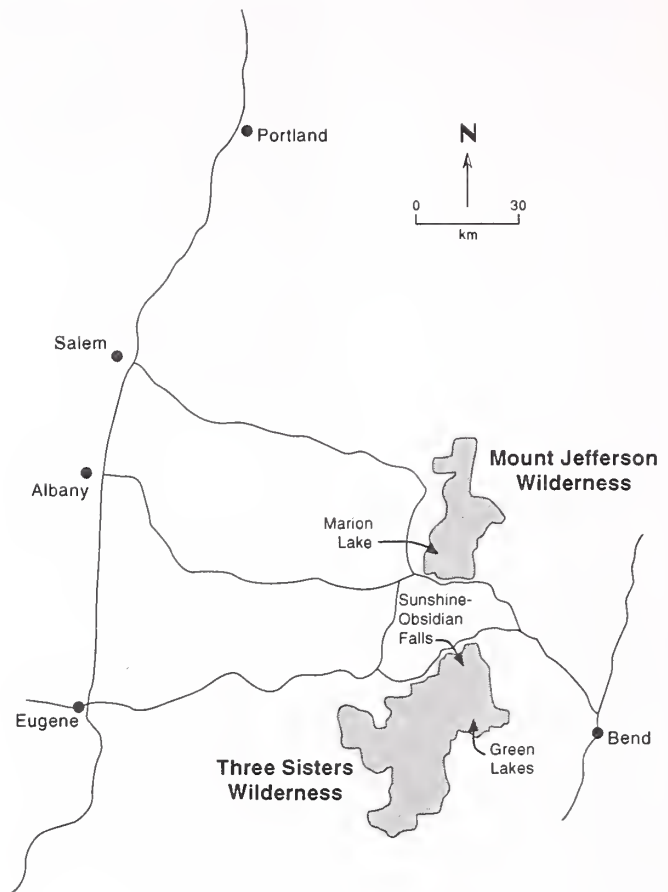


Figure 2—Location of the Marion Lake destination area within the Mount Jefferson Wilderness and the Sunshine-Obsidian Falls and Green Lakes destination areas within the Three Sisters Wilderness, OR.

indicator of potential social impact problems. Third, we conducted exit interviews with visitors to understand their responses to conditions in these areas.

Recreation Impacts

Methods were designed to rapidly quantify the areal extent and degree of impact caused by recreation. We evaluated system trails maintained by the Forest Service, social trails (user-created), campsites, and disturbed lakeshore. We also quantified the extent of restoration activities on trails and campsites.

The total length of system trails was measured and five potential types of trail problems were identified: root exposure, incision, braiding, excessive width, and muddiness. Whenever trail segments with any of these

problems were encountered, the length of that segment was measured. Root exposure was considered a problem if the roots were loose on the surface, had soil excavated from beneath them, or if the likelihood of stumbling over them was great. Trails were considered to be incised if the tread was greater than 25 cm below the outslope edge of the trail. Trails were braided if there was more than one adjacent, parallel tread. Trails were considered excessively wide if the width of the tread exceeded 1.5 m. Finally, trails were considered muddy if they remained muddy through mid-summer dry spells. From these data, the length and proportion of system trails with "problems" were calculated. Using an estimate of mean trail width, it was also possible to estimate the disturbed and bare area associated with system trails.

All social trails were mapped and classified according to level of disturbance. The length of trail segments in each of three condition classes was measured. Class 1 trails are disturbed but retain at least 20 percent vegetation cover. Class 2 trails have less than 20 percent vegetation cover but are less than 0.5 m wide. Class 3 trails have less than 20 percent vegetation cover and are more than 0.5 m wide. Using an estimate of mean trail width, we estimated the disturbed and bare area associated with the social trail system.

In some places, system trails and social trails have been closed to use. We measured the length of these closed trail segments and described the actions that had been taken to keep use off the trails and promote recovery.

All places obviously disturbed by camping were located, regardless of whether camping is currently allowed or whether they have been closed to camping and then revegetated. At each campsite we estimated the disturbed area and the barren area. In contrast to the barren area, disturbed portions of the campsite retain some vegetation cover. Area was estimated by considering the site to approximate some combination of geometric shapes (rectangles, triangles, or circles) and pacing the appropriate dimensions. Within campsite boundaries, all trees greater than 1.5 m tall were counted and noted to be either damaged or not. Damaged trees were those that had been felled or that had obvious scars or large cut branches. Finally, the number of fire scars (fire rings or places where fires have obviously been built) were counted.

A condition class was calculated for each campsite to provide a single indicator of overall campsite impact. Three categories were defined for each of four impact parameters: tree damage, camp area, bare area, and number of fire rings and scars. Categories for tree damage were: (1) no more than broken branches, (2) one to eight scarred trees or one to three badly scarred or felled trees, and (3) more than eight scarred trees or

more than three badly scarred or felled trees. Categories for camp area were: (1) less than 50 m², (2) 50 to 100 m², and (3) more than 100 m². Categories for bare area were: (1) less than 30 m², (2) 30 to 60 m², and (3) more than 60 m². Categories for fire rings and scars were: (1) no fire ring and no more than one fire scar, (2) one fire ring but no more than two fire scars, and (3) more than one fire ring or more than two fire scars.

Campsites were assigned a condition class of 1 (low impact) if the mean rating for these four parameters was 1.5 or less, a class of 2 (moderate impact) if the mean was between 1.5 and 2.25, and a class of 3 (high impact) if the mean was greater than 2.25. These classes, while reflecting subjective decisions about which impacts to include and their relative importance, provide a simple, integrative means of distinguishing between more and less impacted campsites.

These data provide a quantification of the total area disturbed by camping, total barren area, total number of damaged and felled trees, and total number of campfire scars, as well as mean campsite condition and the proportion of sites with different levels of impact. We also noted whether sites were currently available for camping or closed to further use. For sites that were closed, we noted the actions that had been taken to keep people off the site and to promote revegetation.

By summing the area disturbed along system trails, social trails, and at campsites, a total area of disturbance was calculated. A total barren area was calculated in a similar manner. Both disturbed area and barren area were then expressed as a proportion of the total land area of the destination. The destination area was generally defined as the basin within which the destination lakes sit. In the case of the Sunshine-Obsidian area, the destination was defined as the area within and immediately upslope of the trail loop. The surface area of the lakes was subtracted from total area to obtain the total land area of the destination.

Finally, we walked the accessible portions of lakeshores and measured the linear length of shoreline obviously disturbed by human activities. The primary evidence of shoreline disturbance was vegetation impact (reduced density or stature) and shoreline erosion caused by human or stock trampling. Total shoreline length was estimated from topographic maps, which allowed us to express shoreline disturbance caused by recreational activities as a proportion of the total shoreline.

Social Impacts

Various methods were used to assess encounter levels. In all areas, exiting visitors were given a brief questionnaire to fill out. Details on sampling methodology are given in the following section on the visitor

survey. At Alpine Lakes, visitors were asked how many other groups they encountered on the trail and at the lake. Visitors were asked how many other groups they came within speaking distance of, as well as how many other groups they saw but did not come within speaking distance of. These two estimates have been combined into a definition of an encounter, which implies seeing the other groups, regardless of whether they were within speaking distance.

Estimates were for encounters during the entire trip, which occurred in 1 day for day visitors and over multiple days for overnight visitors. In the Oregon areas, visitors were also asked how many other groups they saw. Here, however, estimates were for encounters during a single day—a round trip for day users and an exiting day for overnights. Consequently, reported encounters are usually much lower for overnight visitors than for day visitors in the Oregon areas. In all areas, overnight visitors were asked how many other groups were camped within sight or sound of their camp.

Independent estimates of encounters were made by trained observers at Alpine Lakes. The trained observers followed selected groups at a comfortable distance along the trail and around the destination lake, without intruding or making themselves obvious to the groups they were following. They recorded the number of groups that were encountered by the group being observed. Observations at the lake lasted for 30 minutes. Campsite encounters were assessed by recording (1) the intervisibility of sites, (2) the ability for groups in adjacent sites that were not intervisible to hear each other, and (3) which campsites were occupied each night. The number of campsite encounters recorded for a group was the number of occupied campsites that were visible or within hearing distance from their site.

Independent estimates of encounters were made by wilderness rangers in the Oregon wildernesses. Rangers kept records of the number of groups they encountered while hiking the trails during 1 day. Campsite encounters were recorded using the same approach as in the Alpine Lakes.

Visitor Survey

Visitors were surveyed onsite. This was considered preferable to mailback surveys because of the large numbers of day users and our interest in accurate recall. Consequently, interviewers contacted the first two members of each group as they exited at the trailhead and asked them to fill out a short, 10-minute questionnaire. Almost all individuals agreed.

At Alpine Lakes, sampling was conducted on one weekend and one 3-day sequence of weekdays each month from mid-July to mid-September. This amounted

to 15 total sampling days in each location. At Green Lakes and the Sunshine-Obsidian area, sampling was conducted on randomly selected days, stratified by weekdays and weekends or holidays. There were a total of 23 sampling days at Green Lakes and 29 sampling days at Sunshine-Obsidian. The Marion Lake sample was a convenience sample, consisting of 6 weekday and 9 weekend days. The usable sample size was 591 visitors at Snow Lake, 144 visitors at Rachel Lake, 60 visitors at Rampart Lakes, 465 visitors at Green Lakes, 361 visitors at Marion Lake, and 334 visitors at the Sunshine-Obsidian Falls area. Although the proportion varied substantially between destination areas, 68 percent of the visitors surveyed were day visitors.

Descriptions of Destination Areas

Snow Lake

The Snow Lake trailhead is at the end of a paved road less than 2 km off Interstate 90, close to the crest of the Cascade Mountains at Snoqualmie Pass. It is about a 1-hour drive for the 2½ million people living in the Seattle metropolitan area. Snow Lake (fig. 3) is about 5 km from the trailhead on a well-graded trail with an elevation gain of about 350 m. In 1994, more than 8,000 groups used the Snow Lake trail; about 90 percent were day visitors. Most use and the resultant impact was focused on the system trail that accesses the lake and the southeastern portion of the lake (fig. 4). Rugged topography makes much of the lakeshore relatively inaccessible.

Snow Lake has been a focus of wilderness management activities for decades. Problems with heavy use have been dealt with through education, regulation, ranger patrol, and an intensive site restoration program. Bulletin boards are posted at the trailhead and close to the lake. The primary regulation in effect in 1991 and 1992 was a prohibition on campfires. Visitors were encouraged to use certain trails and to camp on one of three designated campsites, although camping was allowed almost anywhere, including 47 other campsites around the lake basin. Preferred trails and campsites were noted on the lakeside bulletin board, as was the location of a toilet (table 1). Since our studies were conducted, permits have been required for all visitors, but the number of permits issued is not limited.

Twenty trail segments were closed, although only two segments were being actively revegetated (table 2). Eleven campsites were closed, of which seven were being revegetated. Sixty signs and 150 m of string, used to keep people off closed sites, provided abundant evidence of intensive management at the southeastern end of the lake (fig. 5).



Figure 3—Snow Lake is a highly scenic attraction readily accessible to millions of people living in the Seattle metropolitan area.

Rachel Lake

The Rachel Lake trailhead is at the end of a gravel road less than 15 km off Interstate 90, about 15 km east of Snoqualmie Pass. This is about a 90 minute drive for Seattle residents. Rachel Lake is about 7 km

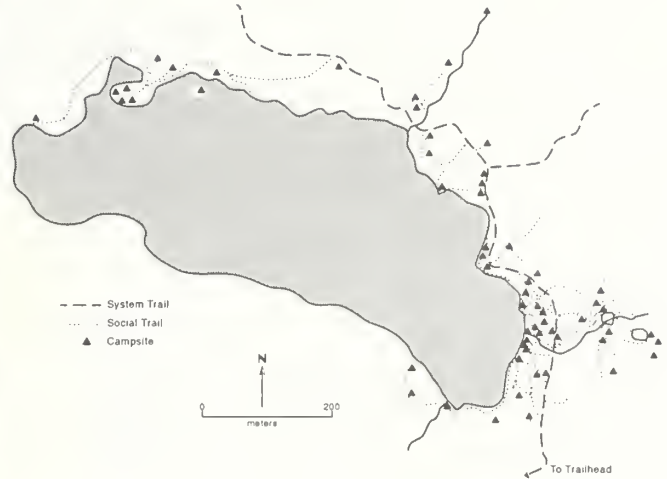


Figure 4—System trails, social trails, and campsites at Snow Lake. Some of the social trails and campsites are closed to use.

from the trailhead on a minimally constructed trail that rises gradually for the first 5 km and then climbs steeply to the lake. Total elevation gain is about 500 m, with most of that in the last 2 km. In 1994, about 1,650 groups used the trail to Rachel Lake. About 80 percent of these visitors were day visitors.

At Rachel Lake, use and impacts were concentrated at the northeastern portion of the lake (fig. 6). Evidence of management activities is limited, confined primarily to wooden signs (stakes with a red line through a boot print) on closed social trails (table 2). The primary user regulation in 1991 and 1992 was a prohibition on campfires. Currently, permits are required for all visitors but not limited in number.

Rampart Lakes

Rampart Lakes is 1.5 km and a 150 m climb beyond Rachel Lake. In 1991, 29 percent of the visitors who reached Rachel Lake continued on to Rampart Lakes. If this proportion is still valid, about 350 to 450 groups

Table 1—Regulations and facilities within destination areas in 1991 to 1992.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Regulations						
Campfires prohibited	Yes	Yes	Yes	No	Yes	No
Campfires prohibited in some places	—	—	—	Yes	—	Yes
No camping zones	No	No	No	Yes	Yes	No
Within-area signs						
No campfires	Yes	No	No	Yes	Yes	Yes
Informational bulletin board	Yes	No	No	Yes	No	No
Toilet provided	Yes	No	Yes	Yes	No	No
Recommended campsites	Yes	No	No	No	No	No

Table 2—Extent of trail and campsite closures in 1991 to 1992.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Trail closures						
Number of trails	20	25	57	0	1	0
Length of trails (m)	435	365	578	0	250	0
Signs (number) ^a	20	42	133	0	0	0
Length of string ^a (m)	30	0	108	0	0	0
Revegetated segments (number)	2	0	0	0	1	0
Campsite closures						
Closed sites (number)	11	0	0	16	98	6
Posted sites (number)	11	0	0	0	9	6
Revegetated sites (number)	7	0	0	6	4	0
Closed area (m ²)	961	0	0	5,260	9,695	1,357
Revegetated area (m ²)	265	0	0	542	702	0
Signs (number) ^a	40	0	0	0	9	6
Length of string ^a (m)	119	0	0	200	100	200

^aSigns with text or symbols that ask visitors to keep off closed sites; string provides a symbolic barrier to entry.



Figure 5—Attempts to restore damaged trails and campsites are evident at Snow Lake.

visited Rampart Lakes in 1994 (29 percent of the 1,650 groups who used the Rachel Lake trailhead, minus some unknown proportion that did not reach Rachel Lake). Sixty-three percent of visitors to Rampart Lakes in 1991 were day visitors. Use and impacts were widely distributed among the three major and three minor lakes that make up the 50 ha Rampart Lakes basin (fig. 7). Trail closures were particularly abundant. In 1991, 133 wooden signs were used to close 57 trail segments. There also was a pit toilet.

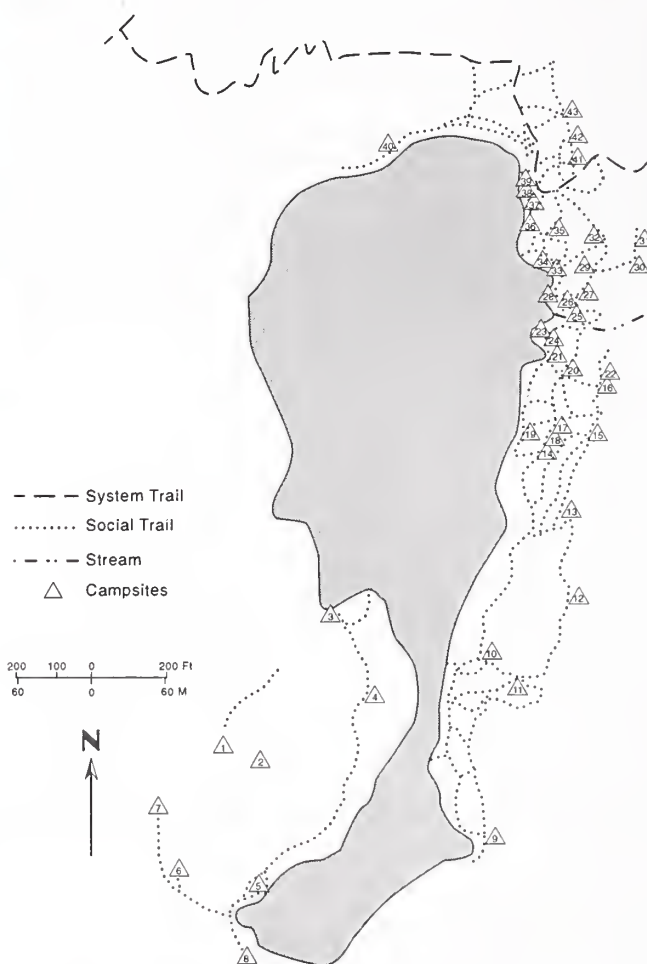


Figure 6—System trails, social trails, and campsites at Rachel Lake. Some of the social trails are closed to use.

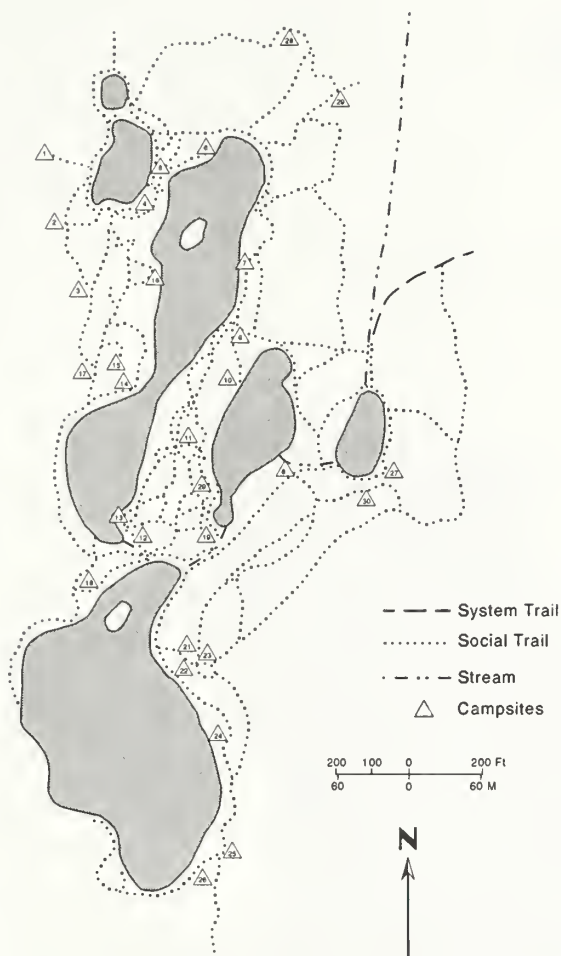


Figure 7—System trails, social trails, and campsites at Rampart Lakes. Some of the social trails are closed to use.

Marion Lake

The Marion Lake trailhead is about 100 km east of Albany and Salem, OR, at the end of a 7 km gravel road. It is about a 2 hour drive from Portland, the largest metropolitan area in Oregon, but closer to other cities in the Willamette Valley. Marion Lake is about 6 km from the trailhead on a well-constructed trail with an elevation gain of about 250 m. Prior to the designation of the Mount Jefferson Wilderness in 1968, Marion Lake sported a boathouse and other structures. It was heavily used by groups who carted boats and other gear to the lake on wheelbarrows and more elaborate wheeled devices. Much of this gear was chained to trees and stored over winter.

In 1991, about 1,400 groups visited Marion Lake; about 50 percent were day visitors. In contrast to the study areas in Washington, Marion Lake and the other Oregon study areas receive some stock use, although hiking is the most common mode of transportation.

Management has always been a challenge at Marion Lake. Early efforts focused on stopping people from using mechanized means of transporting gear and storing gear at the lake. In 1987, a portion of the lakeshore was closed to camping, and many cut stumps were removed from this day-use area. In 1988, more extensive site restoration was begun, and a large sign was erected where the trail meets the lake. Although impacts were spread around much of the lakeshore, they were most concentrated at the two locations where trails first reach the lake (fig. 8). In 1991 and 1992, evidence of site restoration was confined to about 200 m of string on six campsites that were being actively revegetated (table 2). In 1989, campfires were prohibited within 30 m of water and trails. Currently, permits are required but not limited.

Sunshine-Obsidian Falls Area

The primary trailhead to the Sunshine-Obsidian Falls area is at Frog Camp on Highway 242, about 100 km east of the Eugene-Springfield metropolitan area. This is a popular subalpine area, without large lakes (fig. 9), that offers spectacular views of the North and Middle Sisters. The trail system consists of a 6.5 km loop around the Sunshine-Obsidian Falls area, accessed by a 6 km trail from Frog Camp. Total elevation gain is about 500 m.

In 1991, about 1,100 groups visited the area; about 50 percent were day visitors. A sign located at the trailhead explained regulations and suggested low-impact practices. Campfires were not allowed within one-quarter mile of trails, and camping was not allowed within 30 m of water or a trail. Evidence of site management within the area was confined to nine signs and 100 m of string at closed campsites (table 2), as well as routed wooden signs along trails stating the camping and campfire regulations. Impacts were widely dispersed, although there were a few areas of concentrated use and impact (fig. 10). Currently, permits are required and use limits were implemented in 1995.

Green Lakes

The Green Lakes trailhead is on the Cascade Lakes Highway about 40 km west of Bend, OR. Green Lakes is about 7 km from the trailhead on a well-constructed trail with an elevation gain of about 300 m. Three lakes and two ponds lie at the base of South Sister in a complex mosaic of conifer islands, meadows, and open expanses of sand and pumice.

In 1991, about 2,300 groups visited Green Lakes, more than three-quarters of whom were day visitors. Permits were required for entry into the area in 1991, but were not limited. A volunteer was at the trailhead every day during the summer to issue permits and provide information. A bulletin board at the trailhead

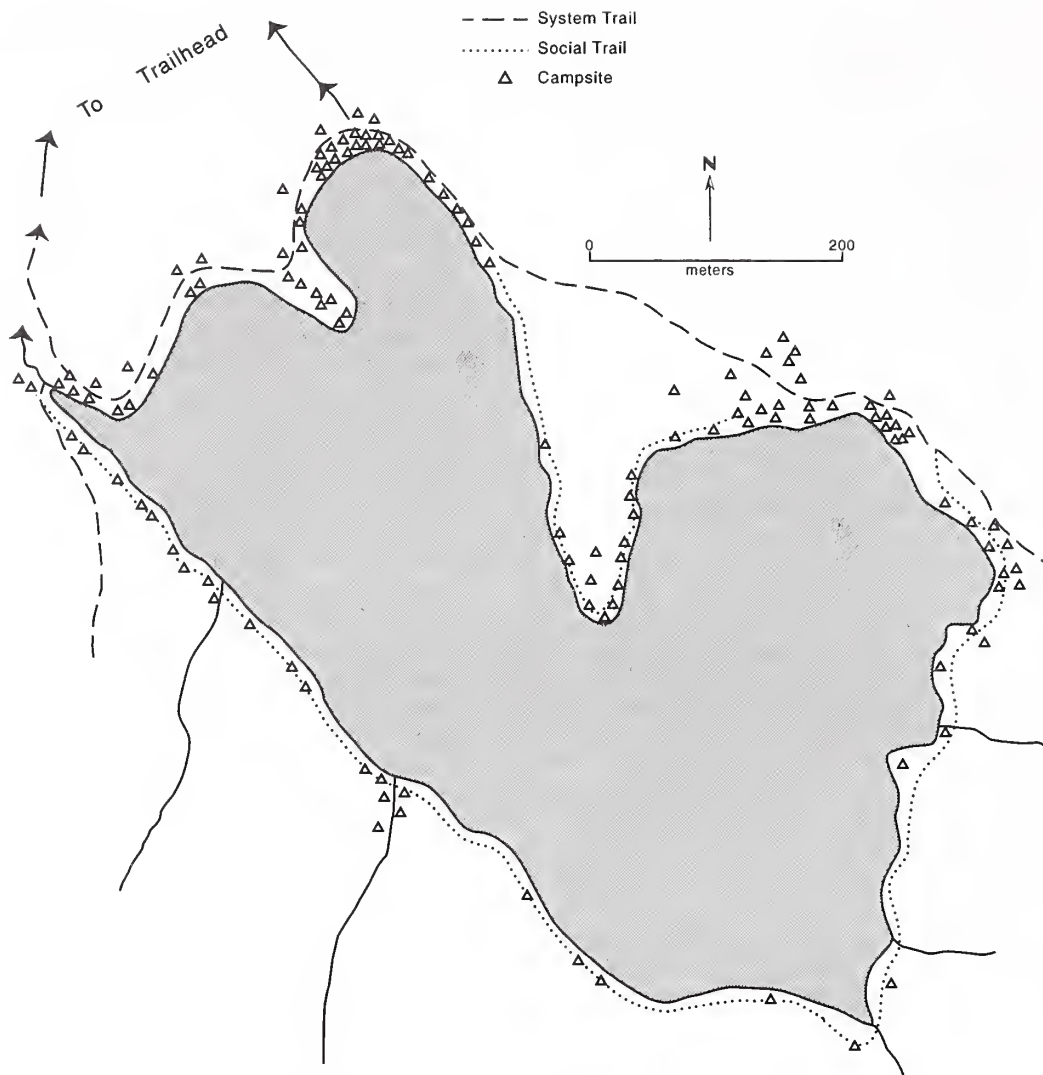


Figure 8—System trails, social trails, and campsites at Marion Lake. Some of the campsites are closed to overnight or all use.



Figure 9—Overview of the subalpine meadows and wide vistas that characterize the Sunshine-Obsidian Falls destination area.

explained regulations and provided low-impact use suggestions. Campfires were not allowed within 1 km of Green Lakes. Signs noting the campfire prohibition were posted along trails 1 km from the lakes. Rangers patrolled the area on most days during the summer, and volunteers picked up trash and removed fire rings at least three times each year. Impacts were widely distributed, although there were a few locations with concentrated impact (fig. 11). Evidence of site management within the area was confined to six signs and 200 m of string at closed campsites (table 2).

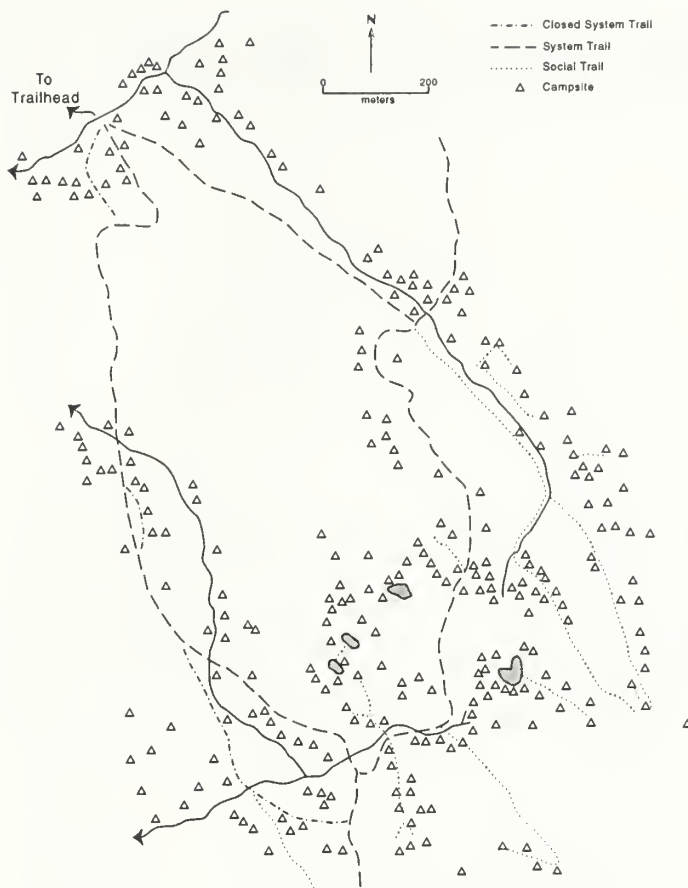


Figure 10—System trails, social trails, and campsites in the Sunshine-Obsidian Falls area. Some of the trail segments are closed and many of the campsites are closed to overnight use.

Visitor Encounter Levels

Encounters between visitors occurred frequently in all areas, although encounter rates were highly variable spatially and temporally. Encounter rates varied about threefold between these areas, and encounters on trails were often an order of magnitude more frequent than encounters on campsites. Off-trail, it is often possible to avoid encounters entirely. Encounter rates were typically about three times higher on weekends than on weekdays and, not surprisingly, were much higher during the day than in the evening or night.

Encounter rates reported by visitors at the end of their trip differed from those recorded by trained observers and wilderness rangers. These three sources of data differ in both what was measured and in precision. The ideal method would precisely measure what visitors actually encounter. Of these methods, trained observers come closest to this ideal. Self-reports suffer

from low precision, unless the variable of interest is visitors' perceptions of what they encountered. Wilderness ranger reports suffer because they measure what rangers encountered—not what visitors encountered. Although data from all three methods are reported in tables 3 and 4, the following discussion is based on the most precise techniques—records of trained observers (at Alpine Lakes) and wilderness rangers (in the Oregon areas).

The highest encounter rates were experienced on trails during the weekend by day visitors to Snow Lake. Trained observers reported a mean of 53 encounters with other groups—almost 200 people—during the hike to and from Snow Lake, a hike that typically lasted 2.9 hours (table 3). This means that, on average, other groups were encountered every 3.2 minutes on the trail. Another 10 groups were typically encountered at the lake. This lower number for lake encounters is somewhat misleading because, in contrast to trail encounters, lake encounters often last a long time. A measure

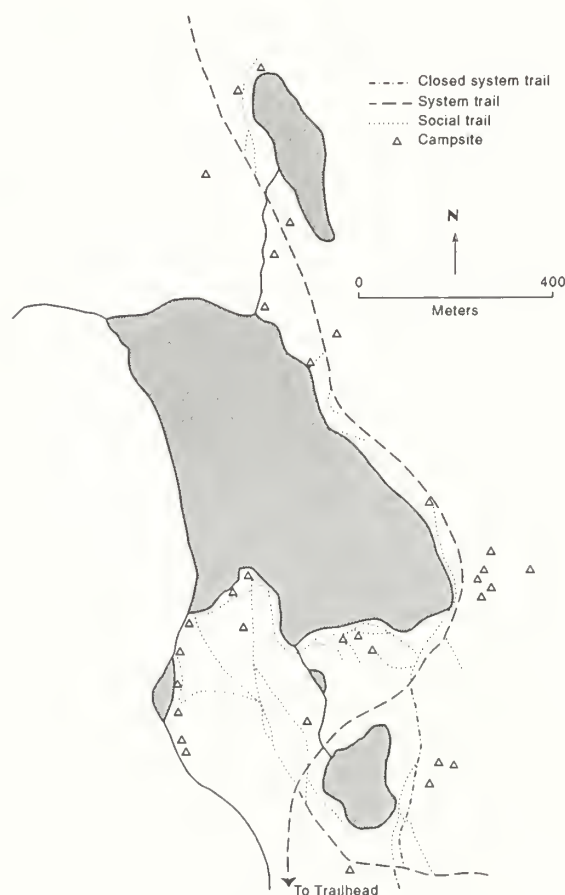


Figure 11—System trails, social trails, and campsites at Green Lakes. Some of the trails are closed, and some of the campsites are closed to overnight or all use.

Table 3—Mean number of groups encountered on trails and at destination areas on weekends.

	Snow Lake	Rachel Lake	Rampart Lakes ^a	Marion Lake	Sunshine-Obsidian	Green Lakes
Trail encounters ^b						
Self reports	36	21	27	—	—	—
Trained observers	53	35	4	—	—	—
Lake encounters ^b						
Self reports	11	7	7	—	—	—
Trained observers	10	4	4	—	—	—
Trip encounters ^c						
Self reports—day users	—	—	—	12	10	17
Self reports—overnight users	—	—	—	5	9	12
Wilderness rangers	—	—	—	14	12	18
Campsite encounters ^d						
Self reports	1.4	4.1	4.4	1.1	1.8	3.2
Trained observers	1.2	1.1	1.4	—	—	—
Wilderness rangers	—	—	—	0.9	1.9	1.7

^aRampart Lakes encounters only include those that occurred between Rachel Lake and Rampart Lakes. Anyone visiting Rampart Lakes would likely experience most of the trail encounters experienced by visitors to Rachel Lake. Hence the difference between self reports and trained observers.

^bAt Alpine Lakes, encounters during the day were divided into those on the trail and those at the lake; the two methods used were self reports at the trailhead and a smaller sample based on observations of trained observers. For overnight users, trail encounters occurred on more than 1 day. Only day users reported lake encounters. Observers only counted lake encounters for 30 minutes.

^cIn the Oregon areas, trip encounters were recorded from self reports at the trailhead and by wilderness rangers. Day-user self reports should be equivalent to self-reported trail and lake encounters at Alpine Lakes. Overnight users only recorded encounters for the last day of their trip, which only included the hike out.

^dNumber of other groups camped within sight and sound.

Table 4—Mean number of groups encountered on trails and at destination areas on weekdays.

	Snow Lake	Rachel Lake	Rampart Lakes ^a	Marion Lake	Sunshine-Obsidian	Green Lakes
Trail encounters ^b						
Self reports	14	11	18	—	—	—
Trained observers	19	7	2	—	—	—
Lake encounters ^b						
Self reports	5	4	1	—	—	—
Trained observers	3	2	1	—	—	—
Trip encounters ^c						
Self reports—day users	—	—	—	5	6	11
Self reports—overnight users	—	—	—	3	4	8
Wilderness rangers	—	—	—	6	6	11
Campsite encounters ^d						
Self reports	0.4	1.1	0	1.2	0.5	1.8
Trained observers	1.1	0.5	0	—	—	—
Wilderness rangers	—	—	—	1.4	0.9	1.6

^aRampart Lakes encounters only include those that occurred between Rachel Lake and Rampart Lakes. Anyone visiting Rampart Lakes would likely experience most of the trail encounters experienced by visitors to Rachel Lake. Hence the difference between self reports and trained observers.

^bAt Alpine Lakes, encounters during the day were divided into those on the trail and those at the lake; the two methods used were self reports at the trailhead and a smaller sample based on observations of trained observers. For overnight users, trail encounters occurred on more than 1 day. Only day users reported lake encounters. Observers only counted lake encounters for 30 minutes.

^cIn the Oregon areas, trip encounters were recorded from self reports at the trailhead and by wilderness rangers. Day-user self reports should be equivalent to self-reported trail and lake encounters at Alpine Lakes. Overnight users only recorded encounters for the last day of their trip, which only included the hike out.

^dNumber of other groups camped within sight and sound.

of proportion of time spent in sight of others would probably have been more meaningful. It would not be uncommon for a group at the southeast end of Snow Lake to be within sight and sound of other groups for their entire stay at the lake. In addition, trained observers only counted encounters for 30 minutes; many visitors stayed much longer. By evening, however, most visitors left, and the mean number of other groups camped within sight and sound was 1.2 groups.

Weekday encounter levels on the Snow Lake trail, and at the lake during the day, were only about one-third the weekend encounter levels (table 4). The typical group visiting on weekdays encountered another group every 9 minutes on the trail and three other groups at the lake. The number of other groups camped within sight and sound, according to trained observers, was the same as on the weekend.

Encounters during the day were much higher for the areas in the Alpine Lakes Wilderness than the areas in the Oregon wildernesses. Weekend day visitors to Rachel Lake or Rampart Lakes typically encountered 30 to 40 other groups, while weekday day visitors encountered 10 to 15 other groups. For a group spending 1 hour at the lake, other groups were encountered every 8 to 10 minutes on weekends and every 20 to 30 minutes on weekdays.

In the Oregon areas, weekend day visitors typically encountered 12 to 18 other groups, while weekday day visitors encountered 5 to 11 other groups. Of the Oregon areas, encounter rates were highest at Green Lakes, where other groups were typically encountered every 15 minutes on weekends and every 25 minutes on weekdays. At Sunshine-Obsidian and Marion Lake, day visitors typically encountered other groups every 20 to 25 minutes on weekends and every 50 minutes on weekdays.

Campsite encounter levels were less variable between areas than trail encounters. In contrast to trail encounters, visitors have substantial control over campsite encounters because they can select campsites that are away from other groups. Self-reported campsite encounter levels were often much higher than those recorded by trained observers. This might be explained by the substantial interaction between groups that occurs during the day, even though most campsites are out of sight of each other. An alternative explanation is that campers who arrived late in the evening were missed by the trained observers and wilderness rangers.

Variation in campsite encounters may depend more on the intervisibility of campsites than the number of other campers. Mean weekend encounter levels ranged from 0.9 other camps within sight and sound at Marion Lake to 1.9 other camps at Sunshine-Obsidian. Marion Lake is the most densely forested of the areas, while Sunshine-Obsidian is characterized by subalpine

meadows and wide vistas. Weekday campsite encounter levels were substantially lower than weekend encounter levels at Rachel Lake, Rampart Lakes, and the Sunshine-Obsidian area.

Recreation Impacts

Impacts of recreation use are abundant in all areas. The Forest Service system trails that were built to provide access to and within these areas are a human impact, even though the impacts were intentionally created. Unplanned impacts occur along extensive systems of social trails and on campsites. Finally, the attraction of visitors to lakeshores has resulted in evident disturbance.

The most extensive system trails are in the Sunshine-Obsidian and Green Lakes areas (table 5); the least extensive system trail is the segment from Rachel Lake to Rampart Lakes. In all areas, most of the trail system is in good shape (table 5). The proportion of system trails with one or more of the problem conditions was 10 to 16 percent in all areas except Sunshine-Obsidian, where 25 percent of the trail system had problems. Excessive trail width was the most common problem in all areas except Rachel Lake, where root exposure was the foremost problem.

User-created social trails are prevalent in all areas (fig. 12). Only in the Sunshine-Obsidian area is the social trail system less extensive than the system trails within the destination area. In all areas, most social trails are almost completely devoid of vegetation (table 6). The proportion of devegetated and wide social trails is particularly high at Sunshine-Obsidian and Green Lakes where the vegetation is sparse and the topography is flat.

All of these destination areas have numerous campsites; some are highly impacted. Marion Lake and Rachel Lake have the largest proportion of severely impacted campsites (table 7). About 50 percent of the campsites at these lakes have a condition class rating of 3, on a scale from 1 (low impact) to 3 (high impact). At Rampart Lakes, in contrast, only 3 percent of the campsites have a condition class rating of 3.

The intensity of impact on individual campsites at Snow Lake, Rampart Lakes, and Sunshine-Obsidian is relatively low compared with campsites studied elsewhere. This is an unexpected finding because these areas are heavily used. For example, mean campsite area in these places is 40 to 78 m² (table 8), compared with a mean area of 200 m² or more in such wildernesses as the Eagle Cap Wilderness, OR (Cole 1982), Bob Marshall Wilderness, MT (Cole 1983), and the Boundary Waters Canoe Area Wilderness, MN (Marion 1984). Size of bare area, proportion of damaged trees, and number of fire scars are also relatively

Table 5—Extent of impact on system trails.

	Snow Lake	Rachel Lake	Rampart Lakes ^a	Marion Lake	Sunshine-Obsidian	Green Lakes
	----- m (percent of trail) -----					
Total length	5,761	6,267	1,588	6,232	11,492	8,911
Impacted length	908 (16)	906 (14)	151 (10)	987 (16)	2,896 (25)	1,186 (13)
Exposed roots ^a	55 (1)	409 (7)	18 (1)	25 (<1)	11 (<1)	26 (<1)
Incised ^b	126 (2)	46 (1)	24 (2)	125 (2)	410 (4)	0
Braided ^c	320 (6)	158 (3)	39 (2)	0	225 (2)	0
Too wide ^d	401 (7)	273 (4)	70 (4)	735 (12)	2,250 (20)	1,160 (13)
Muddy ^e	6 (<1)	20 (<1)	0	102 (2)	0	0

^aRoots loose or with daylight beneath.

^bIncision of ≥ 25 cm on downslope trail edge.

^c \geq Two adjacent treads with common junction.

^d ≥ 1.5 m wide.

^eTread muddy during dry season.



Figure 12—Social trails are particularly evident in the Rampart Lakes destination area.

low. Most individual sites at Green Lakes are lightly impacted, although they are rather large. Possible explanations for relatively low impact, despite heavy use of these destination areas, include the lack of a strong stock-use tradition and topography and vegetation that discourage site expansion. Only at Rachel and Marion Lakes, where mean bare area is 88 to 119 m² and the mean number of felled trees is 6 to 7 per site, is the intensity of impact on most individual campsites high in relation to that found in other wildernesses.

Any attempt to quantify campsite impact must consider the number of impacted sites as well as the mean condition of impacted sites. Marion Lake and Sunshine-Obsidian have a large number of campsites, while the other areas have more modest numbers of sites (table 9). Consequently, the area disturbed by camping is three to five times greater at Marion Lake

Table 6—Length and condition of social trails in each destination area.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	----- m (percent of total) -----					
Condition class ^a						
1	2,864 (31)	1,132 (27)	1,591 (25)	76 (4)	679 (14)	1,975 (16)
2	3,935 (42)	1,700 (41)	2,872 (46)	1,687 (78)	2,461 (51)	4,953 (40)
3	2,495 (27)	1,297 (31)	1,815 (29)	390 (18)	1,733 (36)	5,305 (44)
Total	9,419	4,185	6,362	2,153 ^b	4,873	3,720

^aCondition classes defined as: 1 = ≥ 20 percent vegetation; 2 = < 20 percent vegetation but < 0.5 m wide; 3 = < 20 percent vegetation; and > 0.5 m wide.

^bOnly about one-third of the social trails at Marion Lake were inventoried.

Table 7—Number and condition class of campsites.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	----- No. (percent) -----					
Condition class ^a						
1	27 (47)	10 (23)	22 (73)	27 (20)	155 (58)	5 (16)
2	17 (29)	13 (30)	7 (23)	31 (23)	92 (34)	18 (56)
3	14 (24)	20 (47)	1 (3)	74 (56)	22 (8)	9 (28)
Mean condition class	1.8	2.2	1.3	2.3	1.5	2.1

^aRating between 1 (low impact) and 3 (high impact) based on camp area, bare area, tree damage, and fire scars.

Table 8—Mean conditions on campsites.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Camp area (m ²)	78	102	40	152	76	188
Bare area (m ²)	44	88	22	119	32	50
Damaged trees (percent)	47	50	23	—	—	—
Fire scars (No.)	1.6	1.3	0.8	1.5	0.7	1.2

Table 9—Aggregate impacts on campsites.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Number of campsites	58	43	30	132	269	32
Disturbance area (m ²)	4,392	4,382	1,205	20,093	19,902	6,016
Bare area (m ²)	2,562	3,797	663	15,664	8,367	1,600
Scarred trees (No.)	117	270	38	1,056	154	67
Felled trees (No.)	76	306	12	745	364	51
Fire scars (No.)	92	55	24	192	172	37

Table 10—Campsite impacts adjusted to account for variation in the size of each destination area^a.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Campsite density (No./ha)	0.4	0.8	0.6	0.5	0.9	0.2
Disturbed area (m ² /ha)	27	84	24	69	64	34
Bare area (m ² /ha)	16	73	13	53	27	9
Scarred trees (No./ha)	0.7	5.2	0.8	3.6	0.5	0.4
Felled trees (No./ha)	0.5	5.9	0.2	2.5	1.2	0.3
Fire scars (No./ha)	0.6	1.1	0.5	0.7	0.6	0.2

^aAggregate campsite impacts were divided by the land area (excluding lake surface area) of each destination.



Figure 13—Campsite impacts are particularly severe at Marion Lake.

and Sunshine-Obsidian than in the other areas. These destinations also have large numbers of scarred and felled trees and fire scars. Rachel Lake also has a large number of scarred and felled trees.

These comparisons are somewhat misleading, however, because the Marion Lake and Sunshine-Obsidian destination areas are much larger than the other destination areas. The most useful comparison would be on the basis of aggregate campsite impact, adjusted for differences in the size of the destination area. For this purpose, we calculated the land area of each destination by estimating the area of the lake basin (for all areas other than Sunshine-Obsidian, where we estimated area of drainages surrounding the trail loop) and then subtracting the surface area of lakes.

This area of the lake basin extended to ridgetops, so much of it is inaccessible to most recreationists.

Campsite impacts are most severe at Rachel Lake and Marion Lake (table 10). At both lakes, many campsites have large bare areas and many damaged trees (fig. 13). At Rampart Lakes, where the number of campsites and mean impact intensity are low, total campsite disturbance is particularly low.

The total area clearly disturbed by recreation (on system trails, social trails, and campsites) varied from more than 37,000 m² at Sunshine-Obsidian to less than 4,000 m² at Rampart Lakes (table 11). However, the proportion of each of these destination areas that has been disturbed by recreation is less variable. Disturbance per unit of land area (excluding surface area of lakes) is greatest at Rachel Lake, where 1.4 percent of the lake basin is disturbed. Disturbance per unit area is lowest at Rampart Lakes and Green Lakes where 0.8 percent of the lake basins are disturbed. Total barren area is greatest at Marion Lake and lowest at Rampart Lakes. On a per-unit-area basis, however, barrenness is greatest at Rachel Lake (1.1 percent) and lowest at Green Lakes (0.3 percent).

The primary source of disturbance varies between destination areas (table 11). System trails are the primary source of disturbance at Snow Lake and Green Lakes. Social trails are the primary source at Rampart Lakes, while campsites are the primary source at Rachel Lake, Marion Lake, and Sunshine-Obsidian. Finally, some lakeshore disturbance occurs in all areas with lakes (table 12). However, the proportion of the shoreline obviously disturbed by recreation exceeds 4 percent only at Snow Lake, where 8 percent of the shoreline is disturbed.

Table 11—Total disturbed area, barren area, and type of disturbance.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Total land area (ha)	160	52	50	293	309	179
System trails						
Disturbed (m ²)	11,400	1,200	200	10,200	15,600	6,000
Barren (m ²)	5,700	600	100	5,100	7,800	3,000
Social trails						
Disturbed (m ²)	3,768	1,674	2,545	2,000 ^a	1,949	1,488
Barren (m ²)	2,600	1,222	1,909	1,500 ^a	1,696	1,250
Campsites						
Disturbed (m ²)	4,392	4,382	1,205	20,093	19,902	6,016
Barren (m ²)	2,562	3,797	663	15,664	8,367	1,600
Total area						
Disturbed (m ²)	19,560	7,256	3,950	32,293	37,451	13,504
Barren (m ²)	10,862	5,619	2,672	22,264	17,863	5,850
Percent of land area						
Disturbed (percent)	1.2	1.4	0.8	1.1	1.2	0.8
Barren (percent)	0.7	1.1	0.5	0.8	0.6	0.3

^aThese are conservative estimates because only about one-third of the social trails at Marion Lake were inventoried.

Table 12—Extent of recreational disturbance along lakeshores.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Green Lakes
Total shoreline (m)	5,024	1,776	2,150	7,200	4,800
Disturbed shoreline					
Length (m)	403	59	80	120	84
Percent of total	8.0	3.3	3.7	1.7	1.8

Clearly, recreation use has caused substantial impact in all these destination areas. Even in these extremely popular areas, impacts remain highly localized, however, seldom affecting more than 1 percent of the land and several percent of the lakeshore.

In all areas other than Rachel Lake, current efforts at site closure and restoration have the potential to substantially reduce impacts (table 2). If current efforts are ultimately successful (closed sites and trails return to natural conditions), less than 0.4 percent of the Snow Lake, Green Lakes, and Sunshine-Obsidian areas, aside from the system trails, will be obviously disturbed by recreation. At Marion Lake and Rampart Lakes, between 0.6 and 0.7 percent of the area will remain disturbed. Only at Rachel Lake, where disturbance has been most pronounced and restoration efforts have been meager, will the disturbed area exceed 1 percent of the land area.

Visitors to Destination Areas

As expected, these areas are more crowded and impacted than most places in wilderness. In deciding how such places should be managed it is important to understand who the visitors to these areas are and how they feel about conditions there. Are visitors to high-use destinations novices with little commitment to wilderness, as they are often characterized, or are they more typical wilderness visitors? How do visitors perceive the conditions they experience in high-use destination areas? How do conditions compare with

expectations, and to what extent do existing conditions detract from visitor experiences? Do visitors support current management, and what are their preferences regarding more intensive management in the future?

Visitor Characteristics

Visitors to these places are diverse. We will report mean characteristics to describe the “typical” visitor. There may be, however, as many atypical visitors as typical ones.

Day visitation predominated at the Snow Lake, Rachel Lake, Rampart Lakes, and Green Lakes areas (table 13). At Marion Lake and the Sunshine-Obsidian area, day and overnight use were approximately equal. In all areas, the mean size of groups was small, typically about three people per group. Overnight groups were larger than day groups in most areas, but particularly at Marion Lake where the mean size of overnight groups was 4.3 people. These group sizes are comparable to or slightly smaller than those reported for wilderness elsewhere (Roggenbuck and Lucas 1987).

Lengths of stay are also typically short, as might be expected in destination areas close to the edge of the wilderness. The mean age of visitors to the Alpine Lakes area, 36 to 38 years, is comparable to other recent reports of the age of wilderness visitors (Cole and others 1995). Perhaps the most unique characteristic of the visitors to the Alpine Lakes is the large

Table 13—Characteristics of day and overnight visitors sampled at each destination area.

	Snow Lake n = 591	Rachel Lake n = 144	Rampart Lakes n = 60	Marion Lake n = 361	Sunshine- Obsidian n = 334	Green Lakes n = 465
Day visitors (percent)	89	76	63	49	42	73
Group size (people)	2.9	2.8	2.6	3.2	2.7	3.6
Length of stay (hours)	—	—	—	3.2	4.8	4.6
Seattle metro area residents (percent)	85	93	91	—	—	—
Overnight visitors (percent)	11	24	37	51	58	27
Group size (people)	2.9	3.1	2.4	4.3	3.7	3.9
Length of stay (nights)	—	—	—	1.9	1.9	1.8
Seattle metro area residents (percent)	94	85	90	—	—	—

proportion of local urban residents. About 90 percent of visitors to these destination areas were from the Seattle-Tacoma metropolitan area, barely an hour's drive from the trailheads.

Most of these visitors are quite experienced in wilderness travel (table 14). The Washington and Oregon areas differed in that first-time visitors were more common at Alpine Lakes, while repeat visitors were more common in the Oregon areas. However, Alpine Lakes visitors had visited more wildernesses than Oregon visitors. A typical Rampart Lakes day visitor, for example, has been to Rampart Lakes twice before and has visited 21 wildernesses in addition to the Alpine Lakes Wilderness. A typical Marion Lake day visitor has been to Marion Lake 12 times and to 14 other wildernesses. In all areas, the mean number of days spent in wilderness during the past year was 7 to 10 days, while the mean number of wilderness trips per year was 3 to 6 trips.

Overnight visitors to Rampart Lakes are unusual because of the high number of days spent in wilderness and the high number of wilderness trips they take each year. Elsewhere, day visitors have more wilderness experience than overnight visitors. Day users are more likely than overnight campers to be repeat visitors; they typically have visited more wildernesses in their life; they spent more days in wilderness during the past year; and they make more wilderness visits per year.

Visitors to high-use destinations are sometimes stereotyped as being novices and not highly attached to wilderness. The data in table 14 indicate that visitors to these high-use destination areas should not be characterized as novices. Compared with visitors to other wildernesses, they are less likely to have visited this particular high-use area before or to have visited it frequently (Cole and others 1995; Roggenbuck and Lucas 1987; Watson and others 1992). They are much more likely to have visited

other wildernesses, however, and to have visited a large number of other wildernesses. Finally, the number of wilderness visits taken and the number of days spent in wilderness is comparable to or greater than in other wildernesses that have been studied.

Visitors to these high-use areas also appear to be highly committed to wilderness (or "attached," using the terminology of Williams and others 1992). When asked whether or not they agreed with the statement "I feel like WILDERNESS is a part of me," about 80 percent of Alpine Lakes visitors agreed. Close to 90 percent agreed with the statement "I get greater satisfaction out of visiting WILDERNESS than other recreation places." Mean scores on the multi-item Likert-type scale developed by Williams and others (1992) were 4.0 to 4.3, on a five-point scale with 5.0 defining the highest degree of attachment to wilderness. These values are substantially higher than those reported for three southern wildernesses (3.4 to 3.8), and comparable to that reported for a lightly used wilderness in Montana (Rattlesnake Wilderness) (4.1) (Williams and others 1992).

At Snow and Rachel Lakes, day visitors were more likely than overnight visitors to exhibit a high degree of wilderness attachment; however, the highest wilderness attachment was exhibited by overnight visitors to Rampart Lakes, where the wilderness attachment score was 4.5. Of these visitors, 91 percent agreed that "wilderness is a part of me," and nobody agreed that they "seldom take time to visit wilderness."

One potential explanation for why such highly experienced and wilderness-attached visitors were found in such relatively crowded and impacted destination areas is that this visit was atypical for them. This possibility is suggested by the fact that first-time visitors to these places are unusually abundant. We evaluated this possibility in more depth by asking people whether other wilderness trips they had taken were "almost always," "usually," "sometimes," or

Table 14—Previous wilderness experience of day and overnight visitors to each destination area.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Repeat visitors to destination area						
Day visitors (percent)	2.62	1.1	1.9	12.1	5.5	2.7
Overnight visitors (percent)	1.3	0.4	2.4	5.1	2.7	2.7
Number of other wildernesses visited						
Day visitors (wildernesses)	20	15	21	14	11	10
Overnight visitors (wildernesses)	12	15	15	7	11	8
Days in wilderness in past year						
Day visitors (days)	9	11	9	8	8	7
Overnight visitors (days)	7	0	13	7	8	9
Wilderness trips per year						
Day visitors (trips)	5.1	5.8	6.3	3.0	4.0	3.6
Overnight visitors (trips)	3.4	4.3	6.6	3.3	3.3	4.0

Table 15—Visitor assessment^a of whether their wilderness trips are typically to high-use destination areas.

	Visitors who indicated they typically visit places			
	Further into the wilderness	With fewer people	With less evidence of	
			Previous use	Management
	----- Percent -----			
Snow Lake				
Day visitors	65	80	66	60
Overnight visitors	72	89	75	71
Rachel Lake				
Day visitors	48	64	49	45
Overnight visitors	58	85	56	52
Rampart Lakes				
Day visitors	48	68	56	81
Overnight visitors	57	62	48	57
Marion Lake				
Day visitors	58	64	56	61
Overnight visitors	56	63	57	60
Sunshine-Obsidian				
Day visitors	50	66	50	61
Overnight visitors	53	69	59	67
Green Lakes				
Day visitors	62	67	55	50
Overnight visitors	69	88	72	68

^aVisitors were asked whether other wilderness trips they had taken were “almost always,” “usually,” “sometimes,” or “never” different in some way from the current trip. Values are the proportion who responded “almost always” or “usually.”

“never” different in some way from the current trip. In all areas, at least one-half of visitors reported that the other trips they took were usually or almost always further into the wilderness (table 15). Most visitors also reported that other trips usually or almost always had less evidence of previous use and of management. Two-thirds or more visitors reported that their other trips were usually or almost always to places with fewer people. More than 50 percent of Snow Lake overnight visitors reported they “almost always” visited places with fewer people.

These results suggest that visits to such high-use destinations are not the norm for the visitors we sampled. This finding, along with the findings that these visitors are both highly experienced and attached to wilderness, refutes the stereotypic characterizations of visitors to high-use destinations that are occasionally advanced. The most unique quality of these visitors appears to be the extent to which they are local urban residents, which may be a characteristic of most visitors to these wildernesses, not just visitors to high-use areas.

Visitor Expectations and Responses to Conditions

It is a well-established principle that visitors’ responses to the conditions they encounter are influenced strongly by their expectations about those conditions (Manning 1986). Consequently, we asked people

how what they experienced differed from what they had expected. We asked this question in relation to the number of people they saw, as well as the number of impacted places and “the number of things that management had done to correct impacts due to previous human use” that they observed.

Regarding number of people and number of impacted places seen, the median response in all places was that what was experienced was the same as what was expected (table 16). For the number of management actions that had been taken, the median response was also “the same as expected” in four places. At Snow Lake and Rampart Lakes, however, most visitors reported that the number of actions they observed exceeded what they had expected. In the four other areas, responses that actions were “more than expected” substantially exceeded the “fewer than expected” responses.

Visitors were asked whether the number of people they met on the trail or at destination areas detracted “a lot,” “a little,” or “not at all” from their enjoyment. Day visitors were asked about encounters at the lake, while overnight visitors were asked about encounters at their camp. Reactions to groups with dogs were explored at Alpine Lakes, while reactions to groups with horses were explored in the Oregon areas. Finally, visitors were asked how crowded they felt on a scale from 1 (not at all crowded) to 10 (extremely crowded).

Table 16—Visitor expectations about numbers of other people, visitor impacts, and management presence.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine- Obsidian	Green Lakes
----- Percent -----						
Number of people seen was:						
Fewer than expected	10	21	25	32	31	24
Same as expected	41	44	42	40	42	43
More than expected	46	32	28	24	25	29
I had no expectation	3	3	5	4	2	4
Number of impacted places was:						
Fewer than expected	27	28	23	28	35	35
Same as expected	52	49	50	49	49	48
More than expected	19	18	25	16	12	12
I had no expectation	2	5	2	7	4	5
Number of management actions was:						
Fewer than expected	10	24	4	18	11	15
Same as expected	39	42	34	45	47	46
More than expected	46	25	52	27	28	26
I had no expectation	5	9	10	10	14	13

Most visitors reported that the number of people they encountered did not detract from their enjoyment (table 16). Except at Snow Lake, 5 percent or less of visitors reported that trail encounters and daytime destination encounters detracted “a lot” from their enjoyment. About one-half of Snow Lake visitors felt that the number of people detracted from their enjoyment, but only about 12 percent felt it detracted a lot. Campsite encounters bothered more people (38 to 56 percent) than daytime encounters at all places other than Snow Lake. Encounters with groups with dogs bothered about the same number of people as encounters with groups without dogs. Encounters with groups with horses bothered a larger proportion of visitors than encounters with groups without horses.

The conclusion that most visitors to these high-use destinations were not bothered by the number of

people they encountered is corroborated by their response to the question about how crowded they felt. The mean rating on this scale was between 2.6 and 4.3 for all areas (table 17). This rating correlates with a description of “slightly crowded.”

In contrast to encounters with other people—which all visitors we sampled experienced—not all visitors noticed visitor impacts or management actions taken to correct impacts. However, most visitors reported that they noticed most of the types of impact we asked them about (table 18). In the Oregon areas, where the question was asked, all visitors noticed horse manure. Worn system trails, user-created side trails, and vegetation loss on campsites were noticed by about two-thirds of visitors. Litter and noise from other groups were noticed by about one-half of visitors. Fewer visitors noticed damaged trees, eroded lake or stream

Table 17—Percent of visitors who reported that the number of other groups they encountered detracted^a from their visit.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine- Obsidian	Green Lakes
Encounters with groups:						
On the trail on the way in ^b	51	36	38	19	33	24
On the trail on the way out ^b	45	32	32	14	30	28
At destination lake	45	31	37	17	—	21
While camping	23	38	47	43	56	46
That had dogs	43	35	41	—	33	33
On horseback	—	—	—	—	55	45
Crowding rating ^c	4.3	3.6	3.5	2.6	3.1	3.0

^aResponses to “did these numbers detract from your enjoyment” were “not at all,” “a little,” or “a lot.” Values are the proportion who responded “a little” or “a lot.”

^bIn Oregon areas, overnight visitors were asked about encounters “on the trail yesterday” and “on the trail today.”

^cVisitors were asked how crowded they felt on a scale from 1 (not at all) to 10 (very crowded).

Table 18—Percent of visitors who noticed different types of visitor impact.

Visitor impacts	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	<i>Percent</i>					
Trails worn by heavy use	70	83	88	59	63	59
User-created side trails	68	90	92	58	56	46
Vegetation loss on campsites	62	69	74	70	57	42
Damaged or cut-down trees	34	37	40	55	33	28
Eroded lake or stream sides	27	39	41	46	38	34
Litter left by visitors	50	44	56	69	41	41
Inappropriate human waste disposal	16	15	20	31	18	17
Noise from other parties	60	56	57	55	47	32
Evidence of illegal campfires	19	37	24	—	—	—
Horse manure	—	—	—	100	100	100

sides, inappropriate disposal of human waste, or evidence of illegal campfires.

Visitors who noticed each type of impact were asked whether these impacts detracted “a lot,” “a little,” or “not at all” from their enjoyment. Compared with the effect of meeting other people, noticing visitor impacts bothered many more people (table 19). For most of the visitor impacts we asked about, at least two-thirds of the visitors who noticed them reported that they detracted from their enjoyment. In some places, more than 30 percent of the visitors who noticed certain impacts reported that those impacts detracted “a lot” from their enjoyment. The impacts that most often detracted “a lot” were litter, vegetation loss on campsites, and horse manure. Inappropriate disposal of human waste and noise from other parties was much more bothersome to overnight visitors than to day visitors.

Although most visitors who notice recreation impacts state that those impacts detracted from their experience, this does not mean that most visitors were

bothered by impacts. A sizeable number of people did not even notice the impacts. Aggregated across all six areas, the only impacts that bothered most visitors (that is, they both noticed the impact and reported that it detracted from their experience) were user-created side trails, vegetation loss on campsites, and horse manure.

With few exceptions, most visitors noticed all of the management actions we asked them about (table 20). The primary exception was at Green Lakes, where only 30 percent of visitors noticed the few places where traffic was routed by string. Only 49 percent of Snow Lake visitors reported noticing the 20 trail segments that were closed there.

Even though these actions were highly evident to most visitors, none of these actions detracted from the enjoyment of more than one-third of the visitors who noticed them (table 21). Day visitors were most likely to feel that traffic routing with string was bothersome, but no more than 9 percent reported this action detracted “a lot.” Overnight visitors were most likely to

Table 19—Of visitors who noticed different visitor impacts, percent who reported that these impacts detracted^a from their visit.

Visitor impacts	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	<i>Percent</i>					
Trails worn by heavy use	68	80	74	51	55	47
User-created side trails	72	83	86	61	65	63
Vegetation loss on campsites	77	76	75	73	79	75
Damaged or cut-down trees	56	63	49	79	71	60
Eroded lake or stream sides	51	66	70	66	70	82
Litter left by visitors	73	70	57	85	74	73
Inappropriate human waste disposal	41	47	37	62	58	59
Noise from other parties	64	57	61	59	55	52
Evidence of illegal campfires	44	72	85	—	—	—
Horse manure	—	—	—	75	75	73

^aResponses of visitors who noticed impacts to “whether they detracted from your enjoyment” were “not at all,” “a little,” or “a lot.”

Table 20—Percent of visitors who noticed different management actions.

Management actions	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	<i>Percent</i>					
Bulletin board at destination	92	—	—	83	91	93
Closed campsites	55	—	—	53	70	59
Campfires prohibited	79	84	96	—	54	52
Revegetation of disturbed sites	83	—	—	68	64	—
Traffic routed with string and stakes	84	81	92	70	56	30
Closed trails	49	69	88	—	—	—
Toilets	72	66	91	—	—	—

Table 21—Of visitors who noticed management actions, percent who reported that these actions detracted^a from their visit.

Management actions	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
	<i>Percent</i>					
Bulletin board at destination	16	—	—	10	4	4
Closed campsites	22	—	—	24	35	34
Campfires prohibited	18	28	21	—	21	9
Revegetation of disturbed sites	24	—	—	18	13	—
Traffic routed with string and stakes	27	22	41	22	29	24
Closed trails	17	19	30	—	—	—
Toilets	12	10	13	—	—	—

^aResponses of visitors who noticed actions to “whether they detracted from your enjoyment” were “not at all,” “a little,” or “a lot.”

feel that the prohibition on campfires was bothersome, with the proportion feeling the prohibition detracted “a lot,” varying from 0 to 5 percent at Rampart and Green Lakes to 26 percent at Rachel Lake.

We asked visitors to evaluate how enjoyable their trip had been overall, compared with other wilderness visits of similar length, by rating it on a 10-point scale. The vast majority of visitors gave their trip a rating of 6 or more—suggesting that their trip had been more enjoyable than most (table 22).

Trip quality ratings were substantially lower for Snow Lake than for the other areas, and were substantially higher for Sunshine-Obsidian and Green Lakes. We can only speculate about these differences between areas. Snow Lake was the destination where visitors felt most crowded and where the largest proportion of visitors had more encounters than they

expected. Sunshine-Obsidian and Green Lakes were not the least crowded destinations, but they were the destinations where the largest proportion of visitors saw fewer impacts than expected.

Preferences for Management

Since limiting use of these areas is one of the oft-mentioned strategies for mitigating problems (Hendee and others 1990), we asked visitors whether they felt a limit on use was needed. We noted in our question that if a limit was enforced it might reduce opportunities to visit the area in the future. Although majorities support the concept of a use limit in all these areas, most visitors do not feel that current use levels are high enough to warrant a limiting use (table 23).

Table 22—Mean visitor response regarding how enjoyable this visit was compared to other wilderness visits.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Trip quality rating ^a	6.8	7.2	7.7	7.5	8.1	8.3

^aTrip quality was rated on a scale of 1 to 10 (10 = as good or better than all previous wilderness trips of similar length).

Table 23—Visitor preferences regarding limits on amount of use, now or in the future^a.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Percent who feel						
Limit needed now to reduce use	19	20	23	10	12	14
Limit now to hold use at current level	20	18	26	13	28	23
Limit in future if overuse occurs	43	49	44	45	47	48
No limit needed now or in the future	18	13	7	33	13	15

^aThe question included a clause informing the visitor that "if a limit is enforced your own opportunity to visit this area may be reduced in the future."

Table 24—Visitor support for possible management techniques.

	Snow Lake	Rachel Lake	Rampart Lakes	Marion Lake	Sunshine-Obsidian	Green Lakes
Percent who favor or strongly favor						
Prohibit camping at lakes	22	19	19	8	—	18
Provide better information on heavy use	67	74	60	61	79	73
Develop more trails	41	29	18	25	20	25
Allow camping only on designated sites	85	79	72	53	44	62
Prohibit dogs	39	40	50	31	34	38
Require dogs to be on leash	52	50	50	47	36	51
Separate day- and overnight-use areas	46	26	28	29	21	34
Close overused sites to all use	68	58	57	50	62	66
Direct traffic with string and stakes	64	67	78	46	47	50
Revegetate impacted sites	90	90	86	77	86	89
Install more toilets	41	41	37	—	—	—
Build bulletin boards at destination	49	48	47	—	—	—
Prohibit horses in some places	—	—	—	53	68	64

Of those who support limiting use now, more visitors feel that use should be kept at current levels than at reduced levels. Typically, only 10 to 20 percent of visitors support a reduction in use. This is comparable to the proportion who feel that use should never be limited regardless of what happens. As has been found almost everywhere this question has been asked, most visitors support the enforcement of use limits at some unspecified time in the future, suggesting that they do not feel these areas are overused currently. This belief is consistent with our finding that numbers of people did not detract from the enjoyment of most trips and the high trip-quality ratings.

Finally, we asked people whether they favored or opposed a variety of more focused management actions, given the conditions experienced on their trip (table 24). Most visitors favored providing better information, allowing camping only on designated sites, closing overused campsites, directing traffic with string and stakes, revegetating impacted sites, and prohibiting horses in certain places (only asked in Oregon areas). None of these actions would represent a pronounced departure from current management programs. In fact, many of these actions have already been enacted.

Most visitors opposed prohibiting camping and developing more trails, although the opposition to these actions was not as great among day visitors as overnight visitors. Finally, visitors were generally neutral about prohibiting dogs, requiring dogs to be on leash, providing separate areas for day and overnight visitors, installing more toilets, and building more bulletin boards at destination areas.

Summary

Visitors to these high-use destinations are generally highly experienced in wilderness travel, and wilderness is extremely important to them. Compared with wilderness visitors elsewhere, they have visited more different wildernesses but have made fewer visits to the study location. They scored high on a wilderness attachment scale. Most visitors indicated that most of their wilderness visits are to places that are less highly used, impacted, and intensively managed. Apparently their attachment is more to wilderness in general than to these specific places.

This suggests that visitors to these high-use areas should not be considered a unique population of wilderness visitors. Instead, they appear to be rather

typical wilderness visitors on a visit that is atypical for them. The most unique characteristic of this population is the unusually large proportion of visitors that come from a local highly urbanized environment—a characteristic that may apply throughout these urban-proximate wildernesses.

For the most part, visitor expectations were in line with what visitors actually encountered. Visitor expectations were not very helpful in explaining what detracted from visitor experiences. Recreation impacts bothered most visitors who noticed them, even though visitor impacts seldom exceeded what was expected. In contrast, management actions seldom detracted from visitor enjoyment, even in the places where the prevalence of management actions exceeded what most visitors expected. Finally, despite very high encounter rates, most visitors were not bothered by their encounters with other people, particularly when those encounters were on the trail as opposed to the campsite.

Despite the apparent problems of frequent encounters and abundant impacts, most visitors reported their trip was more enjoyable than most wilderness trips. Most visitors felt there was no need at the present time for a limit on use. Only 10 to 20 percent were supportive of use reductions. Finally, intensive management of these areas was generally supported. However, along with the lack of support for use limits, most visitors opposed prohibiting camping and developing new trails.

Discussion and Management Implications

The case study approach used here limits our ability to draw general conclusions about high-use destination areas. However, the substantial number of commonalities between these six different destination areas suggests that results might be broadly applicable, at least in wildernesses within a half day's drive of metropolitan areas in the Pacific Northwest.

The questions we asked at the beginning of this study were:

1. How crowded are these places?
2. How do visitors feel about current encounter levels or management attempts to reduce them?
3. How severe are recreation impacts?
4. How do visitors feel about current impact levels or about management attempts to reduce impacts?
5. Which management approaches are most likely to benefit the visitors and resources of these destination areas and surrounding wilderness lands?

We also asked about how these areas have changed over time, but lack the baseline data to address this

question. In the future, our methods can be replicated and this question can be answered.

Encounters, Visitor Evaluations, and Management Preferences

These areas are among the most crowded wilderness destinations that have been studied. Particularly on weekend days, visitors have little opportunity to get away from other people entirely, unless they leave the trail to find places where they can be alone. Daytime encounter levels clearly exceed the levels that many wilderness visitors consider to be ideal for a wilderness—typically no more than about four other groups per day (Cole and others 1995; Stankey 1973, 1980; Vaske and others 1992). Is this situation unacceptable? One of the defining statements in the Wilderness Act is that wilderness is land which “has outstanding opportunities for solitude or a primitive and unconfined type of recreation.” Does this mandate solitude in wilderness?

To answer this question, two issues must be resolved. First, what is an “outstanding” opportunity for solitude? Second, does every place in wilderness have to provide outstanding opportunities for solitude at all times? Perceived crowding and opportunities for solitude vary with both personal characteristics (from person to person) and with situational variables (from time to time and place to place) (Manning 1986). For example, the high encounter levels at Snow Lake are nothing compared to those in the Seattle metropolitan area where most Snow Lake visitors come from. Even though Snow Lake is a relatively crowded wilderness destination, it still provides a relatively high level of solitude for Seattle residents.

Nevertheless, for the sake of argument let us conclude that, because encounter levels exceed those preferred by most wilderness visitors (Cole and others 1995; Stankey 1973, 1980; Vaske and others 1992), these places do not provide “outstanding” opportunities for solitude most of the time. If so, the question of acceptability hinges largely on interpretation of the Wilderness Act. Should the Wilderness Act be interpreted as mandating solitude and, if so, must the solitude criterion be applied at all times to every place in wilderness?

Opinions on these questions are divergent. Some have argued that the Wilderness Act does not mandate solitude when it states that wilderness should provide “...outstanding opportunities for solitude or a primitive and unconfined type of recreation” (emphasis added). Use of the word “or” implies a choice. Solitude is not mandated as long as the recreation opportunities provided are of a primitive and unconfined nature (Winn 1996).

At the other extreme is the view that the Act mandates solitude and that outstanding opportunities for solitude must be provided at all times and in all places. This perspective is reflected in management plans that establish stringent wilderness-wide encounter standards (such as no more than six encounters with other groups per day) or that place limits on the number of all wilderness users. The compromise alternative is that solitude is mandated but that outstanding opportunities need not be provided at all times and in all places.

All three of the wildernesses we studied vary greatly, both in time and space, and in the opportunities for solitude that they provide. These high-use destination areas provide a much higher level of solitude for overnight visitors, who seldom have to camp within sight and sound of more than one or two other groups, than they do for day users. Compared to trail encounter levels, campsite encounter levels are more in line with what has been reported about “acceptable” numbers of encounters, although they are still higher than the ideal of no other campsites within sight or sound (Stankey 1980).

All of these destination areas are within large wildernesses. None of these areas constitute even 1 percent of the wilderness in which they are located. In many other portions of the Three Sisters and Mount Jefferson Wildernesses, for example, weekend encounter rates do not exceed two or three groups per day (Hall and Shelby 1993). This situation is undoubtedly true in the Alpine Lakes Wilderness as well. Since most of these wildernesses provide outstanding opportunities for solitude, it could be argued that wilderness managers provide outstanding opportunities for solitude.

Input regarding the appropriateness of these alternative interpretations of the Wilderness Act could come from at least two groups of people—government legislators and administrators, and the public. Unfortunately, neither legislators nor wilderness managers have explicitly debated or resolved the issues of whether the solitude criterion must be applied in wilderness or whether every acre of wilderness needs to provide outstanding opportunities for solitude.

The data from our study, however, provide evidence of what one important public group—current visitors—thinks about the issue. Although most visitors felt that conditions were at least “slightly crowded,” most reported that this did not detract from their experience. Most visitors reported that their visit was more enjoyable than most previous wilderness visits, suggesting again that the high encounter levels they experienced were not a serious detractant. Finally, when asked directly if they thought use should be reduced, only 10 to 23 percent felt that this was

desirable. This leads us to conclude that current visitors are not bothered much by the less than outstanding opportunities for solitude these places offer, and that they do not think management should reduce use to provide more outstanding opportunities.

The opinions and management preferences of current visitors to high-use places are discounted by some, however, who argue that these visitors are novices, with little attachment to wilderness and little interest in wilderness-dependent activities. They argue that the opinion of wilderness “purists” be given more credence because they have been displaced from such crowded places (see, for example, Dustin and McAvoy 1982).

We will not attempt to address the question of whether wilderness purists are more valid stakeholders in wilderness management decisions than other visitors. We were able to provide substantial evidence, however, that visitors to these destination areas are at least as experienced and attached to wilderness as visitors studied elsewhere. Substantial evidence suggests that these visitors usually take wilderness trips that provide much more outstanding opportunities for solitude. For this particular wilderness visit, they selected a visit to a more crowded place. Most of these visitors knew what to expect and were not bothered by what they experienced.

Apparently even experienced wilderness visitors, who are highly attached to wilderness and who frequently pursue wilderness-dependent activities, do not consider the level of solitude provided to be a significant problem. Perhaps this attitude reflects the decline in standards of quality that concern Dustin and McAvoy (1982). Alternatively, this attitude might reflect visitors’ knowledge that these high-use destination areas are the exception rather than the rule and that there are numerous other wilderness destinations that provide more outstanding opportunities for solitude.

Physical Impacts, Visitor Evaluations, and Management Preferences

Recreation use has caused substantial impacts in all of these destination areas. The areal extent and magnitude of these impacts are generally not greater than has been reported in many other wildernesses, however, including many wildernesses that are much more lightly used. This is particularly true at Snow Lake, Rampart Lakes, Green Lakes, and the Sunshine-Obsidian area. The reasons for relatively low per capita impact cannot be isolated, but likely influential reasons include (1) the type of user (mostly small hiking groups), (2) the well-developed environmental ethic that is prevalent among experienced

wilderness visitors, and (3) the positive effect of relatively intensive site management programs.

The important question that must be answered, regardless of how impacts here compare with those elsewhere, is whether current impact levels are acceptable. Two ways to approach this are to ask (1) do recreation impacts seriously threaten the ecological integrity of these destination areas, and (2) do visitors consider impacts to be a serious problem? These questions follow from the Wilderness Act's mandates to preserve "natural conditions" and to keep "the imprint of man's work substantially unnoticeable."

Cole and Landres (1996) proposed that the ecological significance of an impact in wilderness is largely a function of the intensity and areal extent of the impact, as well as the rarity or irreplaceability of the attribute being impacted. Where hiking and camping regularly occur, the resultant disturbance is intense—vegetation is gone; soils are compacted; and the organic components of soil are either highly disturbed or absent. So at the scale of individual sites and areas up to 10 ha (the southeast corner of Snow Lake, for example), ecological integrity has clearly been disrupted.

These disturbances are highly localized. At spatial scales larger than 10 ha, disruption is less serious. Even at Rachel Lake, the destination with the most widespread impact, only 1.4 percent of the lake basin has been evidently disturbed. If the impacts of fuelwood collection are considered, this estimate would be somewhat higher because fuel is scavenged beyond campsite boundaries. However, this impact should be reduced in the future; campfires are prohibited in all these destination areas other than Marion Lake.

Finally, there is no evidence that recreation use is threatening rare or irreplaceable elements (such as rare plants or wilderness-dependent wildlife) in these destination areas. Since recreation impacts in these areas only have one of the three characteristics of highly significant impacts—intense disturbance—we conclude that recreation use does not severely threaten the ecological integrity of even these heavily used places.

Visitors spend most of their time on the localized sites that have been highly disrupted. Our visitor survey found that most visitors noticed these impacts and that these impacts bothered most visitors who noticed them. Evidence of recreation impact more frequently detracted from visitor experiences than encounters with other visitors. About two-thirds of visitors who noticed trail and campsite impacts reported that the impacts detracted from the quality of their experience.

Two conclusions can be drawn. First, even though recreation impacts may not severely disrupt wilderness ecosystems at large scales (watersheds and landscapes), locally severe disturbances detract substantially from

the quality of visitors' experiences, violating the intent of the Wilderness Act to keep human imprint "substantially unnoticeable." Second, physical impacts are more of a concern to visitors to these high-use destinations than the number of other visitors they encounter. Together these conclusions suggest that the emphasis of management should be on efforts to reduce the physical impacts of high visitation. Perhaps, if the physical effects of high visitation can be mitigated, large numbers of visitors and resultant high encounter levels are acceptable.

Likely Effects of Alternative Management Approaches

Numerous categorizations of wilderness recreation management approaches have been suggested (Cole and others 1987; Gilbert and others 1972; Hendee and others 1990; Manning 1979; Wagar 1964). Perhaps the simplest categorization of available means of reducing the social and ecological impacts of recreation use would be a distinction between (1) reducing recreation use; (2) changing visitor behavior, primarily through information and education; and (3) intensively managing sites (controlling recreational traffic and restoring damaged sites).

No research data can demonstrate unequivocally which of these strategies is the best management approach. However, in the following section we offer our attempt to think logically about the likely costs and benefits of these alternative strategies in the light of existing research. We recognize that other logics may also be a valid and welcome alternative analyses.

Visitor Education Programs—Many impacts—particularly physical ones—result from visitor behaviors that are unnecessarily harmful. If visitors can be persuaded to practice low-impact behaviors, certain problems should decline in severity (Gilbert and others 1972; Hendee and others 1990). This realization has prompted the widespread implementation of low-impact visitor education programs in wilderness (Douchette and Cole 1993). These programs are in place in all of the destination areas. Messages are presented on permits, on bulletin boards at trailheads, and at Snow Lake on a lakeside bulletin board. Wilderness rangers make frequent patrols and convey low-impact messages to visitors. Subject to budgetary constraints, these programs could be intensified. What are the likely effects of intensifying such programs? How can we characterize the ratio of benefits and costs that are likely to accrue from more intensive visitor education programs?

Benefits of these education programs have already been realized. For example, litter problems in most wildernesses appear to be much less pronounced than they were a few decades ago (Cole and others 1995).

Unfortunately, intensified educational programs are likely to have little effect on the severity of most remaining problems. For example, educational programs are unlikely to cause dramatic reductions in encounter levels. A number of educational programs have been mildly successful in altering use-distribution patterns (see Roggenbuck 1992 for a review). However, more problems may be created than solved if visitation is diverted elsewhere. If visitors go off-trail to find more solitude, one likely result is increased social trailing. If they go to more lightly used trails and destinations, they are likely to cause increases in social and physical problems that are more pronounced than the decreases in problems in high-use areas.

We can think of two exceptions to this generally negative evaluation of the potential of education to deal with the problem of high encounter rates. First, if overnight visitors are careful in their campsite selection (selecting screened sites away from other campers) and onsite behavior (being quiet), campsite encounters could be reduced substantially. However, the real problem in these areas is trail and daytime encounters—not campsite encounters. Second, at the Sunshine-Obsidian area, trail encounters might be reduced by encouraging one-way travel around the trail loop.

The physical resource problems most amenable to mitigation through low-impact education programs are those caused by unnecessary and discretionary behaviors. Litter, tree damage, and improper human waste disposal are the foremost examples of unnecessary impact, while packstock and campfire impacts are the foremost examples of impacts that would not occur if visitors would simply choose not to bring packstock or build campfires. None of these are particular problems in most of the areas. The primary exceptions are Rachel Lake and Marion Lake, where tree damage is a significant problem. Campfires are prohibited in all areas except Marion Lake, and toilets have been provided in three of these areas (table 1).

The primary physical impact problem in these destination areas is the large areal extent of trampling disturbance on trails and campsites. This disturbance, which removes vegetation and organic matter and compacts and erodes soils, is virtually inevitable wherever regular visitation occurs. Education can do little to mitigate this problem. Visitors should be encouraged to concentrate their use on certain campsites and trails. However, this recommendation is likely to have little effect unless an intensive program of site management (site and trail designations and closures) is also in place.

Although the intensification of education programs alone is unlikely to produce many benefits, it is unlikely to have many nonadministrative costs.

Assuming recommendations are appropriate, social and resource impacts are not likely to be exacerbated, either in these high-use destination areas or in surrounding places in the wilderness. Visitors generally do not find educational programs obtrusive (Cole and others 1987), and the administrative costs of education are not particularly high (Douchette and Cole 1993).

Cole (1995) has suggested that the need to adopt direct management approaches (such as use reduction or site management) increases as the specificity and intensity of problems increase. He suggests that education, in contrast, should not be expected to solve specific problems in a short period of time. Education should be preventive medicine rather than a cure. Preventive medicine is always beneficial, but when a specific ailment is identified, the cure must be something more than the preventive medicine. Visitor education is always beneficial if done properly, but when problems are well-defined and severe, as they are in these high-use destinations, something more than education is needed.

We conclude that any substantial improvement of conditions in these high-use destination areas must come from a direct management approach, such as use reduction or intensive site management. Visitor education programs are an important management tool, but should be thought of as general stewardship programs rather than management solutions or as supplements to a direct management strategy.

Reductions in Amount of Use—One of the most obvious approaches to dealing with the problems of high encounter levels and severe physical impacts is to reduce the number of visitors. Use limits are currently being considered for all of these areas. In 1995, they were implemented in the Sunshine-Obsidian area.

What are the likely effects of reducing use both to these specific destination areas and to neighboring portions of wilderness? How can we characterize the ratio of benefits and costs that will likely result from use reductions?

The benefits of use reductions could consist of improvements in social conditions (for example, reduced encounter levels) and reductions in physical impacts. Use reductions would clearly have some positive effects on social conditions within these destination areas. Encounter levels would decline, although probably not in direct proportion to the level of use reduction. There is some evidence that people exhibit “coping behavior” when faced with crowded situations (Hammitt and Patterson 1991). For example, they may subtly change the tempo of their travel and the places they visit in an attempt to reduce encounter levels. We hypothesize that “coping behavior” will decline as use levels decline and, therefore, that encounter levels would not decline as much as the

reductions in use that were implemented. In particular, encounters at day-use destinations and at campsites are less likely to decline dramatically than trail encounters.

Unfortunately, we cannot test this hypothesis with our data. If we assume a proportional decline in trail encounters, a 50 percent reduction in use would translate into a 50 percent reduction in trail encounter rates. At Snow Lake, a 50 percent reduction in use would mean that weekend day visitors would meet other groups every 6.5 minutes of their trip rather than every 3.2 minutes. If reductions in encounters were not proportional to use reductions, even less improvement in conditions would occur. In the least crowded situation we studied, a 50 percent reduction in use at the Sunshine-Obsidian Falls area or at Marion Lake would mean that weekday day visitors would encounter other visitors every 100 minutes instead of every 50 minutes.

Are these improvements in social conditions significant? Do they compensate for the costs of denying access to people who want to visit these places? The costs of access denial depend on how many people are denied access and what they do when access is denied. Costs increase as more people are denied access. If they choose to visit other wilderness destinations, they may increase encounter levels and physical impact levels there as well. If they stay home, the costs are not borne by wilderness but by the visitors who are unable to exercise their recreational choices.

We do not attempt to objectively quantify the benefit-to-cost ratio of reducing use. We believe, however, that the benefits of even a 50 percent reduction in use at Snow Lake (3 additional minutes between encounters) is insignificant in comparison to the cost of denying access to thousands of visitors each year. In contrast, use reductions at Sunshine-Obsidian and Marion Lake would have more substantial benefits (greater increases in time between encounters) and fewer costs (fewer people denied access).

The counterintuitive conclusion to this line of reasoning is that the social benefits of use reductions are least likely to exceed social costs in the most heavily used places. In extremely heavily used places, such as Snow Lake, the costs of denied access overwhelm the small increase in opportunities for solitude that results from use reductions. The only way to overcome this is to reduce use so drastically that meaningful increases in solitude occur. For example, if 80 percent of current weekend day visitors to Snow Lake were denied access, those visitors would only encounter about 12 other groups during the day, which is the Forest Service, Pacific Northwest Region standard for maximum levels of encounters per day in a transition zone. This would be a worthwhile improvement in

conditions, but the costs associated with such a drastic denial of access and displacement of these visitors to other wilderness and nonwilderness lands would be substantial.

Social conditions are only one of the considerations, however. Perhaps use reductions have more benefits and fewer costs in terms of reducing physical impacts. Extensive research shows that the relationship between amount of use and amount of impact is curvilinear (Cole 1987, Marion and Cole 1996). There are two critical implications of this functional relationship. First, unless use levels at high-use destinations are reduced to very low levels, impact levels are unlikely to decline dramatically. Second, if use is diverted from high-use places to lightly used places, those lightly used places are likely to deteriorate dramatically and rapidly.

This suggests that when the concern is physical impact, the benefit-to-cost ratio of use reduction is even less favorable than when the concern is social condition. Benefits are likely to be minimal. The likely costs of shifting use to less heavily used places, in terms of impact proliferation, are likely to be particularly pronounced. This shift of use and impact has already occurred in some places in the Alpine Lakes Wilderness. When use was limited in the Enchantment Lakes Basin in response to serious problems there, those problems became more pronounced in adjacent lake basins. This constant expansion of impact, when actions are taken in individual problem areas, has been dubbed the toothpaste effect (Cole 1993). Like the tube of toothpaste, every time management squeezes one place, problems ooze out someplace else.

A final consideration is visitor support for use reductions. Only 10 to 23 percent of visitors support a reduction in current use levels (table 23). This is the lowest level of support for any management action we asked about other than a prohibition on camping. There is more support for limiting use to current levels—without reducing use—even though this action is not supported by a majority. Limiting use to current levels would, at best, freeze conditions in their current state. No improvement in conditions could be expected.

We conclude that reducing use levels at these destination areas would likely have more negative than positive consequences. Neither encounter levels nor physical impacts would be reduced to any meaningful extent; many people would be denied access, and adjacent areas of the wilderness would likely experience increased encounter levels and levels of physical impact.

Surprisingly, it appears that the benefit-to-cost ratio of use reductions is likely to be more positive outside of high-use destination areas. In less heavily used places, use reductions are more likely to cause

meaningful declines in encounter levels and physical impacts, fewer people are denied access, and fewer people are displaced to adjacent areas that are vulnerable to increased impact.

If management decides to reduce use in high-use destination areas, problems with use-displacement effects could be reduced by simultaneously establishing use limits throughout the rest of these wildernesses. This precludes the possibility of merely shifting problems from one wilderness destination to another. Use limits in more lightly used places would protect them from increases in use that, if they occurred, would significantly degrade both opportunities for solitude and natural conditions. An added benefit of this approach would be that use limits were being enacted where they are most helpful—in the more lightly used portions of wilderness. This approach will either (1) shift use and problems to other wildernesses and nonwilderness lands (where increased impact may also be undesirable) or (2) greatly increase access denial problems and reduce the individual and societal benefits that accrue from wilderness recreation use.

Despite this generally negative conclusion about the costs and benefits of reducing use at these high-use destination areas, we recognize that use of these areas may need to be limited at some point. We suggest that high encounter rates among day users seem to be a poor criterion for setting use limits. Other situations that might provide a better reason for setting limits include: (1) impact proliferation because previously impacted sites are not abundant enough to handle all the people or (2) increasing conflict between groups due to excessive crowding. There is no evidence that either of these situations currently exist in any of these areas.

Intensive Site Management—Site management programs of varying degrees of intensiveness have been employed in all these destination areas in an attempt to reduce physical impacts. Another management action that might be taken is to intensify these programs. The ultimate goal of such programs is to minimize the areal extent of physical impacts by channeling traffic and rehabilitating some portion of the existing physical impacts. Certain trails, day-use areas, and campsites are designated for use; others are closed off and restored. Visitors are asked to use open trails and campsites and to stay off closed campsites and trails. These actions are tailored to the unique problems of each specific destination and should not involve wilderness-wide actions.

What are the likely effects of intensifying such programs? How can we characterize the ratio of benefits and costs that are likely to accrue from more

intensive site management programs? Effects of intensive site management on trail encounter levels are not likely to be substantial. Encounters on system trails (where most occur) should not be affected. Encounter levels at the destination areas during the day might be increased if traffic is concentrated on fewer trails and use areas. However, this effect can be countered by carefully selecting the trails and use areas that are kept open. Open trails and use areas should be widely dispersed and screened from each other. Campsite encounter levels could actually decline, even if use is more highly concentrated, if the sites that remain open are out of sight and sound of each other.

More intensive site management should have a positive effect on the magnitude of physical impacts. In all of these destination areas, the existing number of campsites and social trails is many times greater than what is needed to meet visitor needs. Consequently, it should be possible to reduce physical impacts several fold by closing campsites and trails that are unnecessary. The site restoration efforts that have already been implemented have started this process. For example, once currently closed disturbed sites at Snow Lake, Sunshine-Obsidian, and Green Lakes have been restored, total disturbed area (not including system trails) will be less than 0.4 percent of total area. The effectiveness of intensive site management in reducing campsite impact has been demonstrated in the heavily used Boundary Waters Canoe Area Wilderness (Marion and Sober 1987).

Intensive site management is unlikely to cause use displacement or access denial. One consideration, however, is whether intensive management is intrusive to the point that it detracts from visitor experiences. The results of our visitor survey suggest that this is not likely to be a significant problem. Most visitors noticed the intensive actions that were being taken. Although the number of actions taken frequently exceeded what they had expected, none of these actions detracted from the enjoyment of more than about one-third of the visitors.

A majority of visitors supported such actions as allowing camping only at designated sites, closing overused sites, and directing traffic with string and stakes. Almost everyone supported the revegetation of impacted sites. Visitors appear to respond positively to obvious attempts by management to exercise their stewardship responsibility in mitigating resource impacts. This suggests that, while it is always best to use native materials and designs that blend with the landscape, managers need not be overly concerned about the temporary use of signs and string to control traffic and educate visitors.

The primary drawback to more intensive site management appears to be the financial costs of such a program. To be successful, substantial resources are needed year after year. In addition, site restoration is difficult in harsh high-elevation environments, and insufficient research has been conducted pertaining to how to restore such sites cost effectively.

There is considerable potential to reduce these administrative costs substantially through the use of volunteers. These destination areas are all close enough to metropolitan areas that they could be “adopted” by volunteer wilderness stewardship groups. These groups could work to keep visitors informed, to help direct visitors along designated traffic routes, and to work on restoration projects. However, even well-developed volunteer programs are costly to organize, direct, and maintain.

Combinations of Management Approaches—

As mentioned earlier, visitor education is a critical complement to any direct management approach. Large investments in restoration can be wasted if visitors will not stay off sites that are closed and being restored.

It is worth exploring the potential benefits and costs of simultaneously reducing use and intensifying site management efforts. Most benefits of combining these efforts would occur within the destination areas themselves. Encounter levels and physical impacts should decline. Fewer use areas and social trails would be needed because there would be fewer visitors to each area. Consequently, a larger proportion of the current disturbed area could be closed and rehabilitated.

The costs of this approach are greatly increased administrative costs, access denial, and use-displacement effects. Most benefits are associated with implementation of the site management program, and most costs are associated with the use reduction program. Therefore, if a decision is made to reduce use, there is much to be gained and little to be lost by implementing a site management program. If a decision is made to intensify site management programs, however, the desirability of simultaneously reducing use is more debatable.

Another variation of this approach would be to supplement a site management program with a limit on overnight use, without placing a limit on day use. This would have several benefits. It would maintain or improve levels of campsite solitude, which currently are not far from preferred conditions, and enable managers to reduce the number and areal extent of campsites—the primary contributor to total impact in most of these areas. The costs would include the financial costs of the overnight permit system and the site management program, as well as any access

denial or use-displacement costs that occur. The magnitude of access denial and use-displacement costs would depend on the limits that were imposed and the demand for overnight use. In the short term, costs would be minimal if use levels were frozen at current levels. Over the long term, costs would increase, assuming demand for overnight use increases. Use-displacement costs in other parts of the wilderness could be contained, however, by simultaneously adopting overnight use limits in the entire wilderness.

Suggestions

One of the important questions we could not answer concerns how these areas have changed over the past few decades. Lack of baseline data made this impossible. With the benefit of the data we have collected, it should be possible, however, to assess future changes. We recommend that more wilderness managers collect similar baseline data in their high-use destination areas. This would provide an improved perspective on current conditions and management options and make it possible to evaluate future trends.

The techniques we used can readily be used elsewhere for this purpose. The most time-consuming procedure was the use of trained observers to estimate encounter rates. Although we feel this is the most accurate means of deriving encounter data, the combination of visitor self-reports and wilderness ranger records is probably sufficient for most purposes. In each of the destination areas we studied, visitor surveys (including self-reports of encounter levels) and impact assessments required about 25 person days of work—15 person days of visitor sampling and 10 person days of impact assessment. The time required to assess impacts in other destination areas may be somewhat higher or lower than this estimate, depending on the size of the area and the extent and severity of impacts.

Conclusions

The conditions of these heavily used wilderness destination areas are strongly influenced by the high level of visitation they receive. Encounter rates are extremely high and physical impacts are substantial. Most visitors report that they were not bothered at all by the high encounter levels they experienced and very few were bothered “a lot.” In contrast, most visitors who noticed physical impacts were bothered by them. However, a sizeable minority of visitors did not notice even the high level of physical impact present. Most visitors were not supportive of management actions to reduce use, while most were supportive of intensive site management actions.

Our analysis of the benefits and costs of alternative management strategies suggests that intensifying site management programs would be the most effective way to approximate wilderness management objectives in these high-use destination areas. Site management programs are likely to have substantial benefits to physical conditions and, therefore, to the quality of visitor experiences. The primary costs are administrative in nature.

Our analysis suggests that use reductions, by themselves, are likely to have few benefits and substantial costs. If use reductions are to be implemented, they are likely to be most beneficial in more lightly used destination areas. Consequently, if use reductions are implemented in these high-use destination areas, it would be best to simultaneously establish use limits throughout the wilderness. This should reduce the likelihood that this action will lead to the degradation of conditions in places that currently are lightly used and lightly impacted. To realize the potential benefits of a use-reduction program, it should be supplemented by an intensive site management program. Managers should, however, be concerned about displacement to other wildernesses and to even nonwilderness lands, without use limits. In some places, a region-wide permit strategy might be needed.

Lack of baseline data adds to the challenge of managing high-use destination areas. More widespread information, similar to what we collected, is needed. The methods we used should help managers collect similar data.

Finally, inconsistent interpretations of the Wilderness Act contribute further to the challenge of managing these places. It appears to be accepted that the Act mandates the protection of natural conditions in wilderness. This consistent belief is reflected in the high level of support for management of physical impacts. The place and importance of solitude in wilderness management is more controversial as reflected in the range of opinions about the desirability of limiting or reducing use.

We feel it would be valuable if there were more debate about two related questions:

1. Are outstanding opportunities for solitude mandated by the Wilderness Act, or is provision of opportunities for a primitive and unconfined type of recreation adequate?

2. If outstanding opportunities for solitude are mandated, are they required in all wilderness locations at all times?

Answers to these questions, which ultimately must be decided by society at large, would contribute to more consistent and rational management of high-use destination areas.

References

- Cole, David N. 1982. Wilderness campsite impacts: effect of amount of use. Res. Pap. INT-284. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 34 p.
- Cole, David N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. Res. Pap. INT-312. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 18 p.
- Cole, David N. 1987. Research on soil and vegetation in wilderness: a state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings, national wilderness research conference: issues, state-of-knowledge, future directions; 1985 July 23-26; Fort Collins, CO. Gen. Tech. Rep. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 135-177.
- Cole, David N. 1993. Wilderness recreation management: we need more than bandages and toothpaste. *Journal of Forestry*. 91(2): 22-24.
- Cole, David N. 1995. Wilderness management principles: science, logical thinking or personal opinion? *Trends*. 32(1): 6-9.
- Cole, David N.; Landres, Peter B. 1996. Threats to wilderness ecosystems: impacts and research needs. *Ecological Applications*. 6: 168-184.
- Cole, David N.; Petersen, Margaret E.; Lucas, Robert C. 1987. Managing wilderness recreation use: common problems and potential solutions. Gen. Tech. Rep. INT-230. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 60 p.
- Cole, David N.; Watson, Alan E.; Roggenbuck, Joseph W. 1995. Trends in wilderness visitors and visits: Boundary Waters Canoe Area, Shining Rock, and Desolation Wildernesses. Res. Pap. INT-RP-483. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 38 p.
- Douchette, Joseph E.; Cole, David N. 1993. Wilderness visitor education: information about alternative techniques. Gen. Tech. Rep. INT-295. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 37 p.
- Dustin, Daniel L.; McAvoy, Leo H. 1982. The decline and fall of quality recreation opportunities and environments. *Environmental Ethics*. 4(1): 49-57.
- Fish, C. Ben; Bury, Richard L. 1981. Wilderness visitor management: diversity and agency policies. *Journal of Forestry*. 79: 608-612.
- Gilbert, Gorman C.; Peterson, George L.; Lime, David W. 1972. Towards a model of travel behavior in the Boundary Waters Canoe Area. *Environment and Behavior*. 4: 131-157.
- Hall, Troy; Shelby, Bo. 1993. Wilderness monitoring: Mount Jefferson, Mount Washington, and Three Sisters Wildernesses. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Willamette National Forest, Eugene, OR. 93 p.
- Hammit, William E.; Patterson, Michael E. 1991. Coping behavior to avoid visitor encounters: its relationship to wildland privacy. *Journal of Leisure Research*. 25: 225-237.
- Hendee, John C.; Stankey, George H.; Lucas, Robert C. 1990. Wilderness management, 2d ed. Golden, CO: Fulcrum Publishing. 546 p.
- Manning, Robert E. 1979. Strategies for managing recreational use of National Parks. *Parks*. 4(1): 13-15.
- Manning, Robert E. 1986. Studies in outdoor recreation. Corvallis, OR: Oregon State University Press. 166 p.
- Marion, Jeffrey L. 1984. Ecological changes resulting from recreational use: a study of backcountry campsites in the Boundary Waters Canoe Area, Minnesota. St. Paul: University of Minnesota. 279 p. Dissertation.
- Marion, Jeffrey L.; Cole, David N. 1996. Spatial and temporal variation in soil and vegetation impacts on campsites. *Ecological Applications*. 6: 520-530.
- Marion, Jeffrey L.; Sober, Toivo. 1987. Environmental impact management in a wilderness area. *Northern Journal of Applied Forestry*. 4: 7-10.
- Roggenbuck, Joseph W. 1992. Use of persuasion to reduce resource impacts and visitor conflicts. In: Manfredo, Michael J., ed. Influencing human behavior: theory and applications in recreation, tourism, and natural resources management. Champaign, IL: Sagamore Publishing: 149-208.

- Roggenbuck, Joseph W.; Lucas, Robert C. 1987. Wilderness use and user characteristics: a state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings, national wilderness research conference: issues, state-of-knowledge, future directions; 1985 July 23-26; Fort Collins, CO. Gen. Tech. Rep. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 204-245.
- Snyder, A. P. 1966. Wilderness management—a growing challenge. *Journal of Forestry*. 64: 441-446.
- Stankey, George H. 1973. Visitor perception of wilderness recreation carrying capacity. Res. Pap. INT-142. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 61 p.
- Stankey, George H. 1979. Use rationing in two southern California wildernesses. *Journal of Forestry*. 77: 347-349.
- Stankey, George H. 1980. A comparison of carrying capacity perceptions among visitors to two wildernesses. Res. Pap. INT-242. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 34 p.
- Vaske, Jerry J.; Donnelly, Maureen P.; Shelby, Bo. 1992. Establishing management standards: selected examples of the normative approach. In: Shelby, Bo; Stankey, George; Shindler, Bruce, tech. eds. Defining wilderness quality: the role of standards in wilderness management—a workshop proceedings; 1990 April 10-11; Fort Collins, CO. Gen. Tech. Rep. PNW-GTR-305. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 23-37.
- Wagar, J. Alan. 1964. The carrying capacity of wildlands for recreation. Forest Science Monograph 7. Washington, DC: Society of American Foresters. 23 p.
- Watson, Alan E.; Williams, Daniel R.; Roggenbuck, Joseph W.; Daigle, John J. 1992. Visitor characteristics and preferences for three National Forest wildernesses in the South. Res. Pap. INT-455. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 27 p.
- Williams, Daniel R.; Patterson, Michael E.; Roggenbuck, Joseph W.; Watson, Alan E. 1992. Beyond the commodity metaphor: examining emotional and symbolic attachment to place. *Leisure Sciences*. 14: 29-46.
- Winn, Norm. 1996. Solitude standard isn't requirement of Act. *Signpost for Northwest Trails*. 31(6): 41.

Cole, David N.; Watson, Alan E.; Hall, Troy E.; Spildie, David R. 1997. High-use destinations in wilderness: social and biophysical impacts, visitor responses, and management options. Res. Pap. INT-RP-496. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 30 p.

Six high-use destination areas were studied in the Alpine Lakes, Mount Jefferson, and Three Sisters Wildernesses in Washington and Oregon. Exit interviews were conducted with visitors, and recreation impacts and visitor encounter rates between groups were quantified. Encounter rates were extremely high and impacts were substantial but localized. Visitors were more concerned about high impact levels than high encounter rates. Management implications are explored.

Keywords: monitoring, recreation impacts, recreation use, site management, solitude, use limits, visitor education, visitor encounter



The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

Several Station units conduct research in additional western States, or have missions that are national or international in scope.

Station laboratories are located in:

Boise, Idaho

Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

Moscow, Idaho (in cooperation with the University of Idaho)

Ogden, Utah

Provo, Utah (in cooperation with Brigham Young University)

Reno, Nevada (in cooperation with the University of Nevada)

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, DC 20250, or call 1-800-245-6340 (voice) or 202-720-1127 (TDD). USDA is an equal employment opportunity employer.